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CANMET ANNUAL BIBLIOGRAPHY OF CRUSHING AND GRINDING - 1984

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CANMET ANNUAL BIBLIOGRAPHY OF CRUSHING AND GRINDING 1984

BY

D.C. LUMB

ABSTRACT

This report is a comprehensive bibliography of the latest machinery, techniques and crushing-grinding circuits for the year 1984.

Keywords: Crushing, Grinding, Crushing Mill, Grinding Mill, Grinding Circuit, Process Control, Automation.

RÉPERTOIRE BIBLIOGRAPHIQUE DES TECHNIQUES DE CONCASSAGE ET DE BROYAGE UTILISÉS EN 1984 - TRAVAIL RÉALISÉ PAR CANMET

PAR

D.C. LUMB

RÉSUMÉ

Ce rapport constitue une bibliographie exhaustive de la machinerie, des techniques et circuits de concassage et de broyage les plus récents utilisés en 1984.

Mots clé: Concassage, broyage, appareils de broyage, broyeurs, circuits de broyage, contrôle des opérations, automatisation.

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CANMET ANNUAL BIBLIOGRAPHY OF CRUSHING AND GRINDING 1984

INTRODUCTION

This report presents bibliographical information on the subject of crushing and grinding. Articles were categorized and numbered sequentially according to the yearly quarter in which they were cited. Although some ambiguity may exist in the article allocations, the categories were chosen to facilitate specific subject searches while retaining the convenience of a general breakdown.

REFERENCING SYSTEM

The references in this report were obtained through the CAN/SDI system covering the 1983 issues of the following data bases:

CHEMICAL ABSTRACTS
COMTENDEX
METADEX (Metals Abstracts)
NTIS (National Technical Information Service of the U.S. Dept. of Commerce)
SCIENCE CITATION INDEX

The references were numbered according to the months in which the data bases cited the reference. A photocopy of each article was made and may be found filed according to its reference number at the CANMET Mineral Ore Dressing Laboratories, 552 Booth St. Also at the same location is an author-index listing various authors and their articles for which photocopies have been made.

The references appearing in this report were numbered in the following method:

February, March, April 1983	2170.00 - 2170.58
May, June, July 1983	2200 - 2271
August, September 1983	2300 - 2341
October, November, December 1983	2400 - 2446

ACKNOWLEDGEMENT

I would like to the thank the support and cooperation of W.H. Cameron, J. MacCauley, Canada Centre for Mineral and Energy Technology, and Energy, Mines and Resources Canada.

1984 (A) REVIEW AND GENERAL ARTICLES

2170.05 Bonds, James L. (Arkansas Power & Light Co., Arkansas, USA), "Coal Yard Foundation Stabilized with Cement-Treated Crushed Stone"; Power Eng. (Barrington, Ill.), Vol. 87, No. 9, Sept. 1983, pp. 56-67; ISSN 0032-5961; POENA

1 - Coal Storage; Pavements A524; A406

Bedding coal loss at Arkansas Power & Light (AP&L)'s White Bluff steam electric station was in accordance with the industry average loss, but utility personnel looked for better ways to stabilize the coal storage area. The native soil in the coal storage area is a heavy, silt-like clay. It was obvious that this clay, with a high moisture content, would result in a significant loss in bedding coal had not the base been stabilized. AP&L engineers evaluated numerous methods to reduce the loss of bedding coal. Utilizing data from the Portland Cement Association, and taking advantage of the availability of good local materials, a cement/flyash-treated stone base course was selected as the most economical stabilization method.

2170.14 Bhatia, Virendra, K. (Fuller Co.), "Narmada Cement Barges Clinker to 'Split' Location Grinding Mills"; Pit Quarry, Vol. 76, No. 3, Sept. 1983, pp. 34-39; ISSN 0032-0293; PIQUA

1 - Cement Plants - India A412

India's most modern and largest single line plant went on-stream in 1982. Narmada Cement Co.'s new coal-fired, 1 million TPY plant at Jafrabad, on India's west coast, began producing clinker on September 4, 1982. In western India the concept of barging and 'split' plant locations has been accepted because of railway difficulties during the monsoon season and the selection of convenient ports for the export of cement.

2170.15 Pokora, Robert J.; Muldoon, Terry L.; Bobick, Thomas G. (Gard Inc.), "Noise Control for Aggregate Plants"; Pit Quarry, Vol. 76, No. 3, Sept. 1983, pp. 40-44; ISSN 0032-0293; PIQUA

1 - Crushing and Grinding - Noise Abatement A533; A751

Barrier materials, operator enclosures, and resilient materials were used in a demonstration program for retrofitting aggregate plants for noise reduction. The techniques employed in the program can provide guidelines for designing, installing and evaluating retrofit noise control systems in crushing and screening plants.

2170.20 Leutz, Rudolf; Mathey, J.O. (Bayer Ag. Leverkusen, West Ger.), "Missiling of a Brazilian Chrome Ore/Aufbereitung eines Brasilianischen Chromerzes"; Erzmettal, Vol. 36, No. 7-8, July-Aug. 1983, pp. 360-363; ISSN 0044-2658; ERZMA

1 - Chromite Ore Treatment - Brazil A533

Bayer Do Brasil has been operating a chromite mine in the northeast since 1970. Ore with a feed content of 15 to 25P CR//20//3 is upgraded by scrubbing, desliming, grinding, and gravity separation to 40 to 45p CR//20//3. Due to the amount of undersize fraction, only 60P of the CR//20//3 are recovered. Approximately 30,000 TPY of concentrate are produced for the production of chemicals. In German with English abstract.

2170.21 Bosse, D.G. (Maginet Projects Ayden, N.C. 00000), "Ultrafine Grinding Equipment Types, Capabilities and Choices"; In: Malaghan, S.G., Ultrafine Grinding and Separation of Industrial Minerals, 1983, p. 3; Ref: 000; Pub: Soc. Min. Engineers AIME; Caller No. D; Littleton, CO 80127

Sessions on ultrafine grinding and separation of industrial minerals at the 112th meeting of the American Inst. of Mining, Metallurgical and Petroleum Engineers. Held: Atlanta, GA, 83

LC: 83-82078 ISGN: 0-89520-419-3

2170.33 Carrieri, Jim (McLanahan Corp., Hollidaysburg, PA, USA), "Preventive Maintenance"; World Min., Vol, 36, No. 10, Oct. 1982, pp. 54-55; ISSN 0043-8707; WOMID

1 - Crushing and Grinding - Equipment A533

By following simple but important rules in the upkeep of processing equipment, downtime can be kept to a bare minimum. The rules relate to equipment selection, training, spares, early warning devices and performance monitoring.

2170.34 Rolfsson, Rune (Svedala-Arbra, Research Lab, Sweden), "Selecting Crushing and Grinding Equipment"; World Min., Vol. 36, No. 10, Oct. 1983, pp. 45-47; ISSN 0043-8707; WOMID

1 - Ore Treatment - Crushing and Grinding A533

In selecting equipment, representative samples are essential at the outset. Crushability and grindability work indices and the abrasion index should be determined. The article describes the procedures for measuring these and gives the average value for representative materials.

2170.37 Griesshaber, H.E. (Bechtel Civil & Minerals Inc., Mining & Metals Div.), "Crushing and Grinding: Design Considerations"; World Min., Vol. 36, No. 10, Oct. 1983, pp. 41-43; ISSN 0043-8707; WOMID

1 - Ore Treatment - Crushing and Grinding A533

As larger units of crushing and grinding equipment are developed, the necessary capital investment demands even greater emphasis on efficient design. The purpose of this article is to highlight a few that are currently receiving attention in the course of this developing technology.

2170.41/A Malcolm, M.R.; Braes, J.R.; Neale, J.R. (ZC/NBHC, Australia (AU)), "Milling Operations at New Broken Hill Consolidated Limited"; Conf. Ser.- Australas Inst. Min. Metall., Vol. 12, No. (Broken Hill Conf.), 1983, pp. 307-315; ISSN 0728-7178; CSAMD

CA154001; Lead Zinc Ore Milling Operation, Filtration Lead Zinc Ore, Grinding Lead Zinc Ore, Flotation Lead Zinc Ore

Ore Treatment, Ore Treatment, Zinc Ores, Lead Ores, Ore Treatment, Ore Treatment

2170.41/B Thorne, C.G.; Chilman, G.F.; Lean, P.J. (ZC/NBHC, Australia (AU)), "The Design of an Incremental Grinding Circuit Expansion at New Broken Hill Consolidated Limited"; Conf. Ser.- Australas. Inst. Min. Metall., Vol. 12, No. (Broken Hill Conf.), 1983, pp. 323-333; ISSN 0728-7178; CASMD

CA154001; Lead Zinc Ore Grinding Modification

Ore Treatment, Zinc Ores, Lead Ores

2206 Kostritsyn, V.N.; Peskov, V.V.; Ponomarev, G.P.; Yatsenk, A.A.; Uvarova, E.I. (USSR (SU)), "Improvement of the Beneficiation of Copper-Nickel Ores"; Ogogashch. Rud (Leningrad), Vol. 28, No. 4, 1983, pp. 9-12; ISSN 0029-7263; OBOGA

CA154001; Copper Nickel Pyrrhotite Grinding Flotation

Nickel Ores, Copper Ores, 39393-21-0; 1310-50-5; 110-50-9

2219 Petela, Ryszard (Inst. Techniki Cieplnej Politechniki Slaskiej. Gliwice, Pol), "Exergetic Efficiency of Comminution of Solid Substances"; Fuel, Vol. 63, No. 3, March 1984, pp. 414-418; 9 Refs.; ISSN 0016-2361; FUELA

1 - Coal Pulverizers - Efficiency; Coal - Calorific Value A524

A short description of a method for determining the internal energy increase of material due to enlarging its surface area in a comminution process is given. An exergy balance of the comminution of a solid substance, has been discussed. A method for determining the exergetic effect of comminution, has been presented. Generalized exergetic efficiency of comminuting installation has been defined and the efficiency of the common cases of comminution has been discussed.

2230 Moore, John J. (Univ. of Minnesota, Mineral Resources Research Cent., Minneapolis, Minn., USA), "Developments in Ferrous Production Metallurgy in 1983"; J. Met., Vol. 36, No. 4, April 1984; pp. 74-83; 229 Refs.; ISSN 0022-2675; JOMTA

1 - Iron and Steel Industry - Reviews; Steelmaking - Reviews; Iron Ore Treatment - Reviews; Basic Oxygen Converters - Reviews; Iron and Steel Metallurgy - Physical Chemistry; Plasma Smelting A545; A533; A532; A531

The review covers production; ironmaking raw materials; iron oxide reduction; direct reduced iron; blast furnace practice; hot metal treatment; steelmaking converters; electric arc and plasma smelting; secondary steelmaking; continuous casting; and physical chemistry.

2238 McManus, G.J., "U.S. Steel Unleashes its New Seamless Tube Mill"; Iron Age (16 April 1984), Vol. 227, No. 8, pp. 72-73, 75, 77-78, 80; ISBN: ISSN 0021-1508

92, Seamless Tubes, Iron and Steel Plants, United States

U.S. Steel's Fairfield, Ala. seamless mill is discussed: innovations include the press piercing mill and the retained Mandrell Mill. The plant also has sophisticated gauging systems with a vast computer network, strong, upstream support, bottom-blow oxygen furnaces and an Asea ladle system to provide vacuum treatment, arc reheating and induction stirring. Photographs of the installation are provided.

2248 Kjos, D.M. (Minneapolis Elect. Steel Castings, Minneapolis, MN 00000), "Grinding Uses More Not Less Power"; Mining Engineering, Vol. 36, No. 3, 1984, pp. 290; Ref: 001

2262 Hilleke, A. Frank (USA (US), "Physical Coal Cleaning and Ore Dressing: A Comparison"; Brookhaven Natl. Lab., (Rep.) BNL, No. (BNL-51679, Resour. Coal, Coal Wastes, Ash Proc. Workshop), 1982, pp. 59-65; ISSN 0197-8659; BNLRD

CA151017; Coal Prepn. Ore Beneficiation

Coal Treatment, Ore Treatment

2267 Scott, Arden L., Valentine, Raymond D. (Westinghouse Electr. Corp., El Monte, Calif. USA), "Large Grinding Mill Drives Update"; IEEE Trans. Ind. Appl., Vol. 1A-18, No. 6, Nov.-Dec. 1982, pp. 736-744; 15 Refs.; ISSN 0093-9994; ITIAC

1 - Grinding Mills - Electric Drive; Electric Drive - Variable Speed: A802; A705

2303 Smirnow, Stefan (Mitarbeiter Westfael, Berggewerkschaftskasse, Bochum, Fed. Rep. Ger., 4630 (DE)), "Simplified Assessment of Mechanical Comminution"; Erzmettal, Vol. 37, No. 3, 1984, pp. 130-138; ISSN 0044-2658; ERZMA

CA148003; Size Redn. Mech. Comminution

Size Reduction

2304 Barratt, D.J. (Wright Engineering Ltd.), "Crushing and Grinding"; Min. Eng. (Littleton, Colo.), Vol. 36, No. 5, May 1984, pp. 475-477; 34 Refs; ISSN 0026-5187; MIENA

1 - Ore Treatment - Crushing and Grinding A533

During 1983, technical conferences and SME sessions featured reviews of the latest technology in the design and operation of large vibrating screens, in-pit crushing and conveying systems, and large diameter ball mills. In operations, new projects that came on stream were CMC's Thompson Creek molybdenum mine in Idaho, Getty's Mercury gold mine in Utah, and Placer's Golden Sunlight gold mine in Montana.

2305 Anon. (Aime, Agglomeration Committee, Littleton, Colo.), "Agglomeration"; Min. Eng. (Littleton, Colo.), Vol. 36, No. 5, May 1984, pp. 474-475; ISSN 0026-5187; MIENA

1 - Iron Ore Treatments - Reviews; Iron Ore Reduction - Reviews; Grinding Mills - Ball Milling; Crushers - Reviews A533

In 1983 the low level of steel operations kept most pelletizing and sintering operations at curtailed production levels. The article reviews production and major technological developments in pelletizing, direct reduction and sintering.

2307 Moudgil, B.M.; Ince, D. (Univ. of Florida, Cent. for Research in Mining & Mineral Resources, Gainesville, Fla. USA), "Physical Separation Processes"; Min. Eng. (Littleton, Colo.), Vol. 36, No. 5, May 1984, p. 488; 7 Refs.; ISSN 0026-5187; MIENA

1 - Ore Treatment - Separation A533

The article identifies the major articles published in 1983 on magnetic, electrostatic, gravity and dense media separation and ore sorting.

2308 Addison, R. (Stearns-Roger Engineering Co., Denver, Colo., USA), "Mill Design"; Min. Eng. (Littleton, Colo.), Vol. 36, No. 5, May 1984, pp. 484-486; 39 Refs.: ISSN 0026-5187; MIENA

1 - Ore Treatment - Equipment; Grinding Mills - Ball Milling; Copper Smelting - Equipment; Copper Refining -Equipment; Lead Smelting - Equipment A533

The review discusses new plants and expansions and equipment for crushing, grinding, concentration, leaching, clarification, filtration, smelting and refining and gives their literature citations.

2309 Vasilash, G.S. "Eloxys Nonabrasive Approach to Grinding"; Manufacturing Engineering, Vol. 89, No, 6, 1982, p. 29; Ref: 000

2315 Barclay, G.A., "Steel Castings Used in Crushing and Grinding"; Canadian Mineral Processors Div., 15th Annual Meeting Canada, 18-20 Jan. 1983, Canadian Institute of Mining and Mettallurgy, Energy, Mines and Resources Canada, 552 Booth St., Ottawa, Ontario, Canada K1A 0G1 (1983) 52-57, See: 8409-72-0581

41, Iron Ores, Beneficiation, Copper Cres., Crushers, Materials Selection, Grinding (Comminution), 2.25CR-0.4M), SACM, Hadfield, SAM

Steel castings still comprise the largest volume of wear materials used in crushing and grinding of Fe and Cu ores in the Canadian mining industry. The range of impact and wear properties possible with steel castings enables them to be used successfully in both high impact crushing and milling where abrasion resistance is the main criterion. Approximately 15,000 tons/year of steel mill liners and crusher castings are used by Canadian mines. The properties of the main steel casting alloys used -- Mn, Pearlitic Cr--Mo and Martensitic medium-carbon steels-- are discussed with reference to their applications. Field data on a new application in primary gyratory crushers for martensitic medium-C steels are presented. Liner wear life and mill efficiency can be improved through proper liner design. 7 Refs.

2438 Tanaka, Tatsuo; Iinoya, Koichi (Ed.,); Beddow, John Keith (Ed.); Jimbo, Genji (Ed.) (Dep. Chem. Process Eng., Hokkaido

Univ., Sapporo, Japan (JP)), "Recent Studies on Comminution Published in Japanese Literature"; Powder Technol., (Pap. Int. Symp.), 1981, 1984, pp. 346-353, 53 TFA; Pub: Hemisphere, Washington, D.C.

CA148000; Comminution Review

Size Reduction

2440 Fuerstenau, D.W.; Venkatarman, K.S. (Univ. Calif. Berkeley, Dept. Mat. Sci. & Mineral Engn., Berkely, CA 94720) In: Iinoya, K.: Beddow, J.K.; Jimbo, G., Powder Technol., 1984, pp. 380-387; Ref: 000; Pub: Hemisphere Publ. Corp., 1025 Vermont Ave., N.W., Washington, DC 20005

International Symp. on Powder Technology. Held: Kyoto, Japan 81-9-28 to 10-1

LC: 83-18641 IBSN: 0-89116-285-2

2441 Fuerstenau, D.W.; Moharam, M.R. (Univ. Calif. Berkely, Dept. Mat. Sci. & Mineral Engn., Berkely, CA 94720), "Specific Energy Considerations in Dry Batch Rod Mill Comminution"; In: Iinoya, K.; Beddow, J.K.; Jimbo, G., Powder Technol., 1984, pp. 388-395; Ref: 000; Pub: Hemisphere Publ. Corp., 1025 Vermont Ave., N.W., Washington, DC 20005

International Symp. on Powder Technol. Held: Kyoto, Japan 81-9-28 to 10-1

LC: 83-18641 IBSN: 0-89116-285-2

1984 (B) CRUSHING

2170.04 Tiller, Rick, "Giant Mobile Crusher Can Go 'Face to Face' with its Pit."; Pit Quarry, Vol. 76, No. 4, Oct. 1983, pp. 72-74; ISSN 0032-0293; PIQUA;

1 - Quarries and Quarrying - Crushing and Grinding A502

The largest mobile jaw crusher ever built is operating on the floor of a Rock Springs, Wis. Pit and is capable of producing 1,200 TPH or 12,000 tons per 10-hour shift. The moveable crusher's primary advantages include reduced rock loading and hauling expenses.

2170.08 Guderly, W. (PHB Weserhuette AG, Bad Oeyhausen, West. Ger.), "In-Pit Crushing and Conveying"; Bulk Solid Handl., Vol. 2, No. 3, Sept. 1982, pp. 471-474; ISSN 0173-9980; BHSAD

1 - Conveyors - Belt; Crushers; Mines and Mining - Open Pit A692; A602; A533; A502

The author reviews the factors leading up to the selection of in-pit crushing and conveying technology and discusses the currently available options in equipment selection.

2170.13 Ironman, Ralph (Rock Products, Chicago, Ill, USA), "Mobile Crusher Follows Shovel"; Rock Prod., Vol. 86, No. 8, Aug. 1983, p. 39; ISSN 0035-7464; ROPRA

1 - Crushed Stone Plants; Crushers - Design A412

A mobile crusher-conveyor belt system in operation at Blue Circle's Cement's Swanscombe quarry, Northfleet, Kent, England, moves run-of-quarry stone to the processing plant at less cost than when trucks were used for that purpose. Fed by a 14-CU-M-capacity face shovel, the crusher advances from one point to the next point via a hydraulic walking mechanism whenever the face shovel has covered its entire radius of action. It can also move in eight directions and can turn either left or right on the spot.

2170.31 Anon., "In-Pit Movable Primary Crushers"; Min. Mag., Vol. 149, No. 4, Oct. 1983, 9 p. between pp. 237 and 249; ISSN 0462-6230; MMALA

1 - Crushing and Grinding - Equipment; Quarries and Quarrying - Equipment A533; A502

The article reviews equipment and manufacturers of curshers for surface mines and quarries.

2202 Jacobsen, C., "Interlocks Assure Safe Operation of Hydraulic Rock Crusher"; Hydraulics & Pneumatics, Vol. 371 No. 4, 1984, pp. 37-39; Ref: 000

2204, 2226 Motek, H., "Development of the Hard Rock Crusher/Zur Entwicklung der Hartzerkleinerungsmaschinen"; Aufbereit Tech., Vol. 25, No. 2, Feb. 1984, pp. 80-87; 10 Refs.: ISSN 0004-783X; AUFTA

1 - Crushers A533

Technical development of the hard rock crusher has seen the transition from grey cast iron to cast steel and to welded constructions; from the use of gravity die cast iron to modern, extremely wear-resistant casting alloys; from grease-lubricated sleeve bearings to antifriction bearings, and the introduction of hydraulically operated equipment. Hard rock

crushers have reached a stage of development which hardly seems able to be improved upon within the framework of present technology. In German and English.

2257 Sassos, M.P., "In-Pit Crushing and Conveying Systems"; E&MJ Engineering and Mining Journal, Vol. 185, No. 4, 1984, p. 46; Ref: 003

2258 Revnivtsev, V.I.; Kapralov, Y.P.; Finkelstein, G.A.; Zarogatsky, L.P.; Ivanov, N.A.; Blekham, I.I.; Ivanov, B.G. (Mekhander Inst., Leningrad 199026 USSR), "Selective Liberation of Minerals in Inertial Cone Crushers"; Powder Technology, Vol. 38, No. 2, 1984, pp. 195-203; Ref: 007

2259 Haga, T.; Sait, J. (Ohbayashi Gumi Ltd. Tech. Res. Inst., Tokyo, Japan), "A New Crushing Test for Rock Excavation Properties"; In: Int. Assoc. Rock Mech. Proceedings - Fifth Congress of the International Society for Rock Mechanics, Vols. 1 and 2, 1983, pp. E227-230; Ref: 000; Pub: A.A. Balkema, Rotterdam, P.O. Box 1675, Rotterdam 3000 BR, Neth.

5th International Congress of the International Society for Rock Mechanics: Rock Mechanics for Resource Development, Mining and Civil Engineering. Held: Melbourne, Australia, 83/4

IBSN: 90-6191-236-9

2260 Alhussaini, M. (Kuwait Univ., Kuwait City, Kuwait), "Effect of Particle-Size and Strain on the Strength of Crushed Rock"; In: Int. Assoc. Rock Mech. Proceedings -Fifth Congress of the International Society for Rock Mechanics, Vols. 1 and 2, 1983, pp. E239-243; Ref: 000; Pub: A.A. Balkema, Rotterdam, P.O. Box 1675, Rotterdam 3000, BR, Neth.

5th International Congress of the International Soc. for Rock Mechanics: Rock Mechanics for Resource Development, Mining and Civil Engineering. Held: Melbourne, Australia, 83/4

IBSN: 90-6191-236-9

2312 Anon., "Silicone Fluid Drive Cuts Repairs and Downtime on Clinker Crusher"; Power Engineering, Vol. 88, No. 8, 1984, p. 64; Ref: 000

2318 Anon., "Sizer Breaker Replaces Quarry Primary Crusher"; Rock Products, Vol. 87, No. 7, 1984, p. 29; Ref: 000

2319 Anon., "Moveable Crushers Keep Pace with Quarry Face";, Rock Products, Vol. 87, No. 7, 1984, p. 36; Ref: 000

2334 Microfiche

Miller, H.; Cobey, S.; Murphy, J. (Eagle Crusher Co. Inc., Galion, Oh., Bureau of Mines, Washington, DC), "Low-Profile Portable Crusher for Underground Mining Applications: Construction and Testing"; PB84-232578, 15 June 83, 126 p. (Bumines-Ofr-144-84) Open File Rept., 1 Sept. 78-7 Dec. 82. See also PB80-227515.

08I; 13I, 48A; 94F; *Jaw Crushers, *Underground Mining, Performance Evaluation, Portable Equipment, Feeders, Conveyors, Reliability, Tests, Materials Handling Equipment, Production Capacity, Mineral Deposits, Efficiency, Compressive Strength, NTISDIBM

This report presents the results of a development and testing program for a portable low-profile crusher. The unit has an extremely low vertical profile considering its size and capacity. The crushing jaws that form the crushing chamber are inclined, with the lower jaw mounted for eccentric movement relative to the stationary upper jaw. This provides efficient crushing while also forcing material through the crushing chamber. As a result, the inlet feeder can be disposed horizontally, to facilitate correct processing of different materials, the size of the discharge opening and the action of the movable crushing jaw are variable. The unit also incorporates a feeder hopper and discharge conveyor that provides for efficient ore handling through the machine. Tests demonstrated the crusher's capacity, efficiency, and reliability. During tests, the unit crushed over 120,000 tons of materials of up to 32,000 PSI compressive strength at production rates in the 200- to 350-ton/h range. The unit operated smoothly under simulated low-headroom conditions and proved readily transportable.

2335 Johnson, R.N.; Utley, R.W.; Burkhardt, E.S. (Gard.Inc., Niles, Il.; *Bureau of Mines, Washington, DC), "Movable Crusher Systems-Concepts and Applications"; PB84- 185297, Dec. 82, 178P*. (BUMINES-OFR-75-84), Open File Rept. 22 Nov., 80 - 22 Feb. 82.

08I; 48A*; *Open Pit Mining, *Mining Equipment, *Mine Haulage, Crushers, Conveyors, Maintenance Equipment, Cost Analysis, NTISDIBM

The objective of this report was to evaluate the feasibility and desirability of a movable in-pit crusher combined with conveyors to substantially reduce or eliminate truck or train haulage in large open pit nonfuel mineral mines. The report includes an introduction and summary of previous work, an analysis of movable crusher system components, a description of the selected system. A review of possible movable crusher

system applications, and requirements for future work to bring about the general availability of such systems.

2339 Sinel'nikova, L.N., "Improvement of the Operation of the Crushing Department of the Bougainville Beneficiation Works"; Tsvetn, Met. (1984) (1) pp. 97-99; ISSN 0041-4891

41, Copper Ores, Beneficiation; Crushing; Beneficiation; Crushers; Vibrators; Efficiency

Measures taken at the Bougainville Beneficiation Works (Papua, New Guinea) to improve the operation of the crushing department in the processing of copper-bearing ores are outlined: these include increase in the number of mills and crushers; achievement of the max. capacity of crushers; a modified system of feeding the secondary crushers; protection of motors from thermal overloads; installation of vibrators on the walls of the undersize chutes of crushers; reduction in downtimes of equipment. Output has been increased from 80 to 115 thousand t/day, and the size of the crushed products has been reduced from 9 to 6 mm.

2417 Ansari, Q.A.K.; Ahier, S.J.; Singer, A.R.E. (Univ. Wales, Univ. Coll., Swansea, Dept. Met. & Mat. Technol., Swansea SA2 8PP, W. Glam. Wales), "Crushing Strength and Reduction of Bitumen-Bonded Magnetite Superconcentrate"; Ironmaking & Steelmaking, Vol. 11, No. 5, 1984, pp. 237-245; Ref: 020

2424 Anon. "Development and Operation of Swing Hammer Crushers for Dealing with Wet Sticky Materials"; Aust. Min., Vol. 76, No. 3, March 1984, pp. 48, 50; ISSN 0004-976X; AUMNA

1 - Coal Pulverizers A524

The article briefly describes a lightning crusher and gives typical outputs for three sizes.

2425 Robertson, J.L., "Giant Crusher Handles Oversize"; Rock Products, Vol. 87, No. 10, 1984, pp. 60-62; Ref: 000

2428 Christianus, D.; Koenig, R.; Motz, J.M.; Vollrath, K., "Development of Cast Steels for Primary Hard Rock Crushing in Impactors/Entwicklung von Stahlgusswerkstoffen fuer die Primaere Hartzerkleinerung in Prallmuehlen"; Aufbereit Tech., Vol. 25, No. 6, June 1984, pp. 324-334; 7 Refs.: ISSN 004-783X; AUFTA

1 - Crushers - Materials; Steel Castings - Mechanical Properties A533; A534; A545; A421

This article describes a single-stage Olivine basalt crushing plant with a capacity of up to 300 tons hour, which went into

operation in 1978. The plant consists of just one hard rock primary impactor which can handle a feed of up to 800 mm edge length to produce a material 0 - 56 mm in a single-stage crushing process. This was only made possible by the development of a rotor with a hydraulically operated blow bar locking device with a diameter of 1600 mm, 1500 mm wide. Since this rotor had a tip speed of 44 m/sec, the large feed size imposed considerable demands on the four rows of blow bars in terms of fracture toughness and wear resistance. Operation commenced using blow bars of NI-hard 4, but these were not satisfactory in view of the poor average throughput (16,400 tons), accompanied by frequent failure due to fracturing. By varying the material composition and heat treatment, the toughness and wear resistance could be increased to such a point that, with minimum risk of fracturing, throughputs of up to 40,000 tons were achieved, representing a wear rate of 14 kg of steel per 1000 tons of basalt. Attempts were made to increase the wear resistance by increasing the hardness, but this led to fracturing, thus revealing the limits of development of this material. In German and English.

2436 Tikhontsov, A.M.; Levchuk, A.S., "Improving the Reliability of Swarf-Crushers"; Sov. Eng. Res., Vol. 3, No. 10, Oct. 1983, pp 43-45; ISSN 0144-6622; SORSD

1 - Crushers - Reliability A533; A421; A913

The causes of unsatisfactory operation of swarf-conversion equipment are analyzed. Recommendations are given for improving the reliability of this equipment. A description is provided of the main shortcomings of existing swarf-crusher designs.

1984 (C) GRINDING

GRINDING (i) ROD AND BALL MILLING

2170.18 Austin, L.G.; Rogovin, Z.; Rogers, R.S.C.; Trimarchi, T. (Pennsylvania State Univ., Mineral Processing Section, University Park, PA, USA), "Axial Mixing Model Applied to Ball Mills"; Powder Technol., Vol. 36, No. 1, Sept.-Oct. 1983, pp. 119-126; 19 Refs.: (SSN 0032-5910; POTEB

1 - Grinding Mills - Ball Milling A802; A533; A524; A921

The unsteady-state, one dimensional convective mixing equation was solved with finite end boundary conditions for a pulse of tracer admitted into a steady flow, assuming a

constant dimensionless mixing factor. Radiotracer tests were performed on two continuous wet overflow ball mills, a laboratory mill of 0.3 M I.D. and a pilot-scale mill of 0.91 M I.D. counting through the mill case enabled the tracer concentration to be measured at L/3, 2L/3 and L for the small mill, and L/2 and L for the pilot-scale mill. The results were consistent with the mixing models. The mean residence time of water was about 0.8 that of the solid, showing the slurry density in a mill to be higher than that of the feed and product streams.

2170.22 Shah, I.; Austin, L.G. (Penn. State Univ., University Park, PA 16802), "Breakage Rates and Size Distribution in Dry Ball Milling for Fine Sizes"; In: Malghan, S.G., Ultrafine Grinding and Separation of Industrial Minerals, 1983, p. 9; Ref: 000; Pub: Soc. Min. Engineers AIME; Caller No. D; Littleton, CO 80127

Sessions on Ultrafine Grinding and Separation of Industrial Minerals at the 112th Meeting of the American Inst. of Mining, Metallurgical and Petroleum Engineers. Held: Atlanta, GA, 83

LC: 83-82078 ISBN: 0-89520-419-3

2170.38 Cloos, Ulrich (Doering GMBH, West Ger.), "Cylpebs: An Alternative to Balls as Grinding Media"; World Min., Vol. 36, No. 10, Oct. 1983, p. 59; ISSN 0043-8707; WOMID

1 - Grinding Mills - Ball Milling; Iron Ore Treatment - Crushing and Grinding A533

It is generally cheaper to produce a cylinder with a height equal to its diameter than it is to produce a spherical ball. The advantages of Cylpebs over balls lies in the area, linear, and point contact, which is made by Cylpebs with each other, versus the point contact only, which is made by balls with each other. To verify laboratory testing, mill tests were run on 4,400,000 tons of ore in Liberia for the Bong Mining Company. Throughput for the Cylpeb mill exceeded that of the cast iron ball mill by 8.8 percent and that of the steel ball mill by 8.3 percent. The specific energy consumption was higher by 12.1 percent for the cast iron ball mill and by 7.5 percent for the steel ball mill than for the Cylpeb mill.

2170.46 Spring, R.; Dutton, W.; Larsen, C.; Mular, A. (Noranda Res Ctr Pointe Claire Quebec Canada), "Industrial Ball Mill Model Validation". In: Herbst Ja. Control 84: Mineral/Metallurgical Processing, 1984, pp. 71-76; Ref: 000. Pub: Soc Min Engineers AIME, Caller No D, Littleton, CO 80127; 1st International Symp. on Automatic Control in

Mineral Processing and Process Metallurgy. Held: Los Angeles, CA 84-[illegible]26*3/.

2170.54 Belotserkovskii, V.L.; Golyshev, L.V.; Sinyakevich, B.C. (SO Power Engn. Syst. Adm Kiev, USSR), "The Use of Ejectors to Increase the Drying Capacity of Pulverization Systems with Tube-Ball Mills"; Thermal Engineering, Vol. 30, No. 4, 1983, pp. 216-218; Ref: 004

2170.58 Anon. "INCOMAP's New Superalloy Ball Mill"; Met. Bul., Mon. (Sept. 1983) (153) 47, 49; ISBN: ISSN 0373-4064

71, Superalloys, Structural Hardening, Dispersion Hardening, Ball Mills, MA-754, MA-6000, NI, SP, MA-956, FE

INCOMPA, a new section of the INCO group, is operating a pounds sterling 500 000 high-energy ball mill for the production of oxide dispersion strengthened (ODS) superalloys at the Liea Works of the Wiggins Alloy Company. The charge, comprising Cr, Ni, a Ni-Al-Ti alloy, and Y sub2 0 sub3, is milled with 1m reject ball bearings, which soften and cold-weld with free distributions of refractory powder along the weld interfaces which build up to larger composites and fracture to a constant overall particle size. Each charge is milled for several days to give a tonne of product, and it is hoped to increase the present annual capacity of 53-54 tonnes. The mill is presently working in the INCO Ma-956 20% Cr-4.5% Al iron alloy and will later be used for the ODS Ma-754 and Ma-6000 superalloys, particulars of which are given.

2201 Bamji, P.J., (Alcan Int. Ltd., Kingston Labs. Kingston K7L 4Z4, Ontario, Canada), "Coreless Induction Versus Rotary Furnace Melting of Ball-Milled Drosses"; In: McGeer J.P. Light Metals 1984. pp. 1193-1200; Ref. 000; Pub. Metallurgical Soc. of AIME, 345E 47th St., New York, NY 10017. Technical Sessions on Light Metals at the 113th Annual Meeting of the American Inst. of Mining, Metallurgical and Petroleum Engineers. Held: Los Angeles, CA 84-2/27*3/1.

2243 Howat, D.D., Rept: Mintek Rep. No. M117; Council for Mineral Technology 200 Hans Strijdom Rd., Randburg, South Africa (1983) pp. 20.; 41, (Gold Ores, Beneficiation, Quartzites, White Iron, Service Life, Ball Milling".

Abs.: White-iron balls with a CR content of 12 to > 30% were found to be cost effective in the milling of many types of ores, work was undertaken to show whether balls of such types could be cost-effective in the milling of Au ores. Initially, 14 different types of balls obtained from various sources were tested in a small mill (0.6 M x 0.6 M) using a washed quartzite gravel. At low milling rates, the ball

consumption was high and the performance obtained with the best type of ball was only approximately 50% better than that of the standard, plain carbon-steel drop-forged ball. Under the known economic conditions there did not appear to be any hope that the Cr white-iron balls would be cost effective. Tests were carried out with the same types of grinding balls on the milling of three different base-metal sulfide ores. With these softer ores, the performance of the best type of Cr white-iron balls was much better than that of the standard balls, this improvement in performance becoming steadily greater with increasingly softer ores. A performance index of 850% was obtained for the softest ore (Palabora) as compared with an index of 150% for quartzite.

2246 Sparks, Bryan D.; Meadus, F. Weldon (Chem. Div., Natl. Res. Counc. Canada, Ottawa, Ont., Canada, K1A 0R9 (CA)), "Improved Technique for Monitoring Balling Circuits"; Ind. Eng. Chem. Process Des. Dev., Vol. 23, No. (2), 1984, pp. 406-9; ISSN 0196-4305 IEPDA; CA148003; Balling Circuit Monitoring, Granulation Monitoring Granulation.

2264 Tucker, P. (Warren Spring Lab., Stevenage, England), "Characteristisation of Laboratory Batch Rod-Milling: Size Reduction, Selective Grinding and Mineral Liberation"; PB83-259234, C1982, 70 p.; ISBN-0-85624-261-6; LR-422 (MP)

081; 48A; *Grinding (Comminution), *Rod Mills, *Minerals, Crushing, Particle Size Distribution, Energy, Breaking, Simulation. *Foreign Technology, NTISDFMBR, NTISFNUK

The influence of the milling environment on the wet-grinding of ores was investigated using various configurations of laboratory batch rod-mill and a number of ores. The impact breakage of coarse particles and the production of fines were largely independent. Preferential attrition of some mineral species was identified. The experimental results are discussed in terms of the energies utilized in the comminution process. Guidelines are drawn on how to select the batch-milling parameters to best simulate various comminution regimes. The modelling of several industrial-scale mills, in open and closed circuit, is shown as illustration. (Copyright (C) Crown).

2302 Kanda, Yoshiteru; Hasgeawa, Masahiro; Honma, Torajiro (Yamagata Univ., Faculty of Engineering, Yamagata, Japan). "Fine Grinding by Ball Mill". Nippon Kogyo Kaishi, Vol. 100, No. 1151, Jan. 1984, pp. 41-45; 21 Refs.; ISSN 0369-4194; NIKKA.

1 - Grinding Mills - Testing; Granular Materials - Grinding A533 A802.

An experimental study was carried out to examine the increase in the solid surface produced by a ball mill grinding. Samples used were silica glass, quartz, feldspar, limestone, marble and talc, and the feed size in any sample was 14-20 mesh. The pebble mill consisted of a cylinder, 12.5 cm diameter and 12.5 cm depth, and of procelain balls (2.5 cm diameter) of 1000 g in terms of total ball weight. The grinding was performed at the revolution speed of 87 p of critical one in the feed weight range from 25 to 300 g. The specific surface area was determined by the air permeability method, on assumption that the shape factor of particles was 6. and the size distribution was measured by the centrifugal particle size analyzer and micro sieving. In Japanese with English abstract.

2321 Bennett, K.W.; Iron age, Vol. 227, No. 15, 1984, pp. 42-43; Ref. 000. "Modernized Rod Mill Makes Continental Competitive".

2326 Herbst, J.A.; Robertson, K.; Rajamani, K. (Univ. Utah, Dept. Met. & Met. Engn,, Salt Lake City, UT 84112) In: Westerlund, T. Automation in Mining, Mineral and Metal Processing 1983, pp. 153-160; Ref.: 000; Pub: Pergamon Press Ltd., Headington Hill Hall, Oxford OX3 0BW, UK

4th Symp. on Automation Mining, Mineral and Metal Processing of the International Federation of Automatic Control. Held: Helsinki, Finland, 83-8-22-25, IFAC Conference Proceedings

LC: 84-2794 IBSN: 0-08-030569-5

2336 Fuerstenau, D.W. (California Univ., Berkeley; Bureau of Mines, Washington, DC), "Comminution and Simulation Using Rod and Ball Mills"; PB84-184746, Dec. 83, 82 p. (BUMINES-OFR-81-84) Open File Rept. 26, Jan. 81-25 Feb. 83. See also PB82-104357.

Q81; 48A*; *Ball Mills, *Rod Mills, *Comminution, Grinding Mills, Grinding (Comminution), Wet Mills, Dry Mills, Transport Properties, Simulation, NTISDIBM

This report presents the results of an investigation of comminution in tumbling mills. Five topics involved with ball and rod mill grinding kinetics were studied and the results analyzed in terms of phenomenological size reduction and transport models. Continuous rod mill grinding was found to be characterized by high peclet numbers which permit simulation to be carried out by several methods. The dry-batch ball mill grinding of mineral mixtures showed that the breakage rates of the components were composition-dependent but time dependent and were normalizable with specific energy.

2337 Anon. "Ball Milling Techniques", 1970-July, 1984 (Citations from the Engineering Index Data Base). (National Technical Information Service, Springfield, VA); PB84-873132, Aug., 84, 115 pages. Rep. for 1970-July 84. Supercedes PB83-854083.

13h; 94g*; 41E*; *Bibliographies, *Grinding (Comminution), *Ball Milling, NTISNTISI, NTISNERACD

This bibliography contains citations concerning wet and dry ball milling techniques with various partiuclate materials. Design, material selection, engineering parameters, performance characteristics, and control systems for ball mills are discussed. (This updated bibliography contains 173 citations, 30 of which are new entries to the previous edition.)

2406 Kulmann, K. (Zementind, Forschunginst, Dusseldorf, Fed. Rep. Ger.), "Energy Input in Cement Grinding in Ball Mills - Results of a Balance Analysis of the Grinding Circuit); Zement Kalk Gips, Vol. 37, No. 8, 1984, pp. 421-426; Ref.: 000

2412 Hartley, D.G.; Crockford, G.I.; "Early Experience with Large Ball Mills at Mount Lyell"; Mill Operator's Conference, North West Queensland, Australia, Sept. 1982; Australasian Institute of Mining and Metallurgy, Clunies Ross House, 191 Royal Parade, Parkville, Victoria, Australia 3052 (1982) 179-184; See: 8411-72-0720

41, Copper Ores, Beneficiation, Comminution, Ball Mills, Efficiency

Some twelve months of operation at Mount Lyell, using two large diameter ball mills as a two-stage grinding circuit indicated a shortfall in the grinding capability compared with design criteria breakage, particularly at coarser sizes, was less efficient than with the previously used grinding circuit comprising a large number of smaller diameter mills. This paper describes both old and new equipment, puts forward the facts as they are presently known, and lists the attempts made to overcome the problem.

2432 Tiggesbaumker, P.; Muller, M. (Krupp Polysiu, Beckum, West Ger.), "Influence of Ball Mill Speed on Energy Expenditure and Throughput Capacity"; Pit Quarry, Vol. 77, No. 1, July 1984, pp. 56-63; 13 Refs.; ISSN 0032-0293; PIQUA

1 - Grinding Mills - Ball Milling; Cement - Manufacture A533; A412

In cement production, about 65p of the total electrical energy expenditure is consumed by size-reduction processes. Two-thirds is accounted for by grinding of clinker. Investigations were made on ring motor mills to determine a measure for the quality of a mill and the parameters influencing mill quality.

GRINDING (ii) AUTOGENOUS, SEMI-AUTOGENOUS AND PEBBLE MILLING

2170.35 Maripu, Raivo; Marklund, Olle; Nystroem, Lars-Sune (Boliden Mineral Ab., Swe.), "Evolution of a Highly Successful Grinding Circuit"; World Min., Vol. 36, No. 10, Oct. 1983, pp. 48-53; 8 Refs.: ISSN 0043-8707; WOMID

1 - Ore Treatment - Crushing and Grinding A533

Through 25 years of development and operating experience, Sweden's Boliden Mineral Lab has developed a two-stage autogenous circuit that has proved reliable and cost-effective at the Vassbo, Aitik and Stekenjokk plants operating on complex lead, zinc and copper ores.

2213 Counsell, H.C.; Webber, R. (Denison Mines Ltd., Elliot Lake, Ont. Can.), "Semi-Autogenous Grinding Circuit Reduces Capital Costs"; Can. Min. J., Vol. 104, No. 11, Nov. 1983, pp. 96-98, 100; ISSN 0008-4492; CAMJA

1 - Uranium Ore Treatment - Ontario A533; A911

At Denison Mine's Elliot Lake operations, pilot plant studies showed that two-stage semi-autogenous grinding, with some steel media in the primary mill and pebble media in the second stage, produced stable grinding conditions. This type of circuit was selected for expansion and went into production in 1980.

GRINDING (iii) TOWER MILLS AND OTHER

2170.01 Pavlov, V.A.; Korokin, S.N.; Volchok. Zh.G., "Obtaining Powders by Pulverizing the Waste of Titanium Sponge"; Tsvetn. Met., Jan. 1983, (1) pp. 54-55; IBSN: ISSN 0041-4891

54, Titanium, Powder Technology, Pulverizing, Ball Milling

A study was made of the properties of powders obtained by pulverizing the waste of titanium sponge in a ball mill. This process, carried out in a protective free-flowing medium of sodium chloride, enables mechanical alloying of the powder

to be achieved as a result of screening of the fines, and ensures a considerable reduction in the content in the powder of impurities measuring +0.1—(—1)mm. The powders are recommended for the manufacture of articles operating under small loads in aggressive media.

2170.02 Korol'kov, A.V.; Khodorov, E.I.; Dubov, A.M.; Orlova, T.M.; Dmitriev, P.N. (USSR (SU), "Preparation of a Dry Nepheline-Limestone Charge"; Tsvetn. Met., No. 11, 1983, pp. 36-39; ISSN 0372-2929; TVMTA

CA158001; Nepheline Limestone Drying Grinding Optimization

Process Optimization, Limestone, 1302-72-3

2170.09 Andrievski,, R.A.; Ozneladze, A.Zh.; Petrov, L.N.; Yudin, S.V. (Mosk. Inst. Khim. Tekhnol., Moscow, USSR (SU)), "Grinding of Titanium Carbide and Titanium Nitride Prepared by High-Temperature Self-Propagating Synthesis in an Attritor"; Poroshk. Metall., Kiev, No. 11, 1983, pp. 1-3; ISSN 0032-4795; PMANA

CA157007; Titanium Carbide Nitride Attrition Grinding

Size Reduction, 25583-20-4; 12070-08-5

2170.16 Blauenstein, E.; Bommeli, J.; Wyss, P. (Brown Boveri & Co. Ltd. CH-5401, Baden, Switzerland), "Over 350 000 Service Hours with Gearless Mill Drives from BBC - Their Design Today"; Brown Boveri Review, Vol. 70, No. 11, 1983, pp. 433-438; Ref: 007

2170.24 Conley, R.F. (Mineral & Resource Technol., Mountainside, NJ 00000), "Attrition Milling of Industrial Minerals"; In: Malaghan, S.G., Ultrafine Grinding and Separation of Industrial Minerals, 1983, p. 37; Ref:000; Pub: Soc. Min. Engineers AIME; Caller No. D, Littleton, CO 80127;

Sessions on Ultrafine Grinding and Separation of Industrial Minerals at the 112th Meeting of the American Inst. of Mining, Metallurgical and Petroleum Engineers, Held: Atlanta, GA 83

LC: 83-82078 ISBN: 0-89520-419-3

2170.25 Grimshaw, V.C.; Albus, J.F. (Aljet Equipment Co., Willow Grove, PA 00000), "Fluid Energy Grinding and Drying for Fine Powders Production"; In: Malghan, S.G., Ultrafine Grinding and Separation of Industrial Minerals, 1983, p. 49; Ref: 000; Pub: Soc. Min. Engineers AIME; Caller No. D, Littleton, CO 80127

Sessions on Ultrafine Grinding and Separation of Industrial Minerals at the 112th Meeting of the American Inst. of Mining, Metallurgical and Petroleum Engineers, Held: Atlanta, GA 83

LC: 83-82078 ISBN: 0-89520-419-3

2170.26 Matter, F. (Matter & Partner Ltd, Buchs, Switzerland), "The Use of Fine Size Media to Grind Industrial Minerals by Wet or Dry Process"; In: Malghan, S.G., Ultrafine Grinding and Separation of Industrial Minerals, 1983, p. 65; Ref: 000; Pub: Soc. Min. Engineers AIME; Caller No. D, Littleton, CO 80127

Sessions on Ultrafine Grinding and Separation of Industrial Minerals at the 112th Meeting of the American Inst. of Mining, Metallurgical and Petroleum Engineers, Held: Atlanta, GA 83

LC: 83-82078 ISBN: 0-89520-419-3

2170.27 Hively, E.E.; Jones, S.M. (Koppers Co. Inc., York PA 00000), "Ultrafine Grinding in a Tower Mill"; In: Malghan, S.G., Ultrafine Grinding and Separation of Industrial Minerals, 1983, p. 71; Ref: 000; Pub: Soc. Min. Engineers AIME; Caller No. D, Littleton, CO 80127

Sessions on Ultrafine Grinding and Separation of Industrial Minerals at the 112th Meeting of the American Inst. of Mining, Metallurgical and Petroleum Engineers, Held: Atlanta, GA 83

LC: 83-82078 ISBN: 0-89520-419-3

2170.36 Anon. "Auto Fine Crushing For Fine Particles"; World Min., Vol. 36, No. 10, Oct. 1983, p. 57; ISSN 0043-8707; WOMID

1 - Ore Treatment - Crushing and Grinding A533

By using particle layer compression rather than single particle crusher, Kobe Steel Ltd. of Japan was able to produce a fine product by operating at a large discharge setting.

2211 Giglio, Frank, A.; Stancker, John S. (U.S. Steel Corp., Fairless Works, Fairless Hill, PA, USA), "Installation and Operation of a High-Performance Roll Grinder"; Iron Steel Eng., Vol. 61, No. 2, Feb. 1984, pp. 32-33; ISSN 0021-1559; IRSEA

1 - Rolls - Grinding A535

Backup roll grinding productivity has been tripled following the installation of a revamped automatic 60-in. roll grinder. The design includes a 42-in. dia. 6-in. wide wheel and an automatic control system which employs 15 various speed and feed relationships for each of eight grinding modes.

2214 Bradley, A.A.; Lloyd, P.J.D.; Aime, M.; Stanton, K.H., "The Balancing of a Centrifugal Mill"; J. S. Afr. Inst. Min. Metall. (Oct. 1983), Vol. 83, No. 10, pp. 229-236; IBSN: ISSN 0038-223X

41, Gold Cres, Beneficiation, Mills

A theory for the dynamic balancing of centrifugal mills is presented that takes account of the mass and shape of the charge in a gyrated grinding tube and the way in which the charge lags behind the centrifugal force vector. It predicts that a corresponding lag in the angular position of the counterweight centers of mass is necessary and that the fractional filling should be increased if the ratio of gyration dia. to tube dia. is decreased. A worked example is given for 1 mm centifugal mill that was balanced adequately by the methods described.

2247 Anderson, A.A. "Fine Grind - Make an Accounting of Thy Stewardship"; Mining Engineering, Vol. 36, No. 3, 1984, p. 288; Ref: 000

2256 Honma, T.; Hasegawa, M.; Kanda, Y. (Yamagata Univ. Dept. Chem. Engn., Yonezawa, Yamagata 992 Japan), "Effects of Feed Particle Shapes on Jet Pulverization"; Journal of Chemical Engineering of Japan"; Vol. 17, No. 2, 1984, pp. 221-223; Ref: 005

2269 Stehr, Norbert; Schwedes, Joerg, (Technische Univ. Braunschweig, Inst. fuer Mechanische Verfahrenstechnik, Braunschweig, West Ger.), "Investigation of the Grinding Behaviour of a Stirred Ball Mill"; Ger. Chem. Eng., Vol. 6, No. 6, Nov. 1983, pp. 337-343; 7 Refs.; ISSN 0343-5539; GCETD

1 - Grinding Mills - Ball Milling; Grinding; Solides - Grinding A533; A802; A931

Stirred ball mills are used in several industries for ultrafine grinding of crystalline solids. Up to now, no results of investigations are available which reveal relationships existing between the operating variables and grinding results. In order to remedy this situation, grinding tests were carried out in a horizontally oriented stirred ball mill, employing limestone as the feedstock. Variable parameters were the stirring speed, flow rate and solids concentration of the water-limes tonne suspension.

Mean particle size and surface area per unit volume of the ground product can be satisfactorily calculated for known operating parameters, using an empirical power-product approach. The power consumption of the grinding chamber can be described by an approach which is standard for stirring systems operated in the turbulent regime.

2271 Vibration Isolation of Pulverizing Mills. Malam D.; Newel, J.P.; Roberts, G.P.; In: Dynamic Vibration, Isolation of Pulverizing Mills; 1982. P135-147.

2331 Hoeffl, K.; Husemann, K.; Goldacker, H. (National Aeronautics and Space Administration, Washington, DC), "Influence Parameters of Impact Grinding Mills"; N84-19607/0, Feb. 84, 13 p. (NASI.15:77352; NASA-TM-77352) Transl. into English from Silikattechnik (East Germany), Vol. 32, No. 7, 1981, pp. 213-215, Transl. by Kanner, Leo Associates, Redwood City, Calif.

131; 94F; 41J; *Charge Distribution, *Grinding Mills, *Particle Size Distribution, Efficiency, Parameterization, Translations. NTISNASAT

Significant parameters for impact grinding mills were investigated. Final particle size was used to evaluate grinding results. Adjustment of the parameters toward increased charge load results in improved efficiency; however, it was not possible to define a single, unified set to optimum grinding conditions.

2333 Timm, A.R.; Moench, P.; Moisel, E.; Sommer, G. (National Inst. for Metallurgy, Randburg, South Africa), "Meter for the Measurement of Moisture in Mill Feed"; PB85-120251/XAD, 31 Mar. 84, 23 p. (NIM-2096D; ISGN-0-86999-667-3)

A moisture meter was developed that derives the moisture content of the ore fed to a mill from signals proportional to the conductivity and temperature of the ore. The electrical circuits designed to carry out the necessary measurements are described. Alternative techniques that were considered are discussed in the appendix.

2446 Mayer, Charles B.; Crescenzo, P.J.; Fenton, Dennis A. (Ge. Analytical Engineering Operation Schenectady, NY, USA), "Elimination of Electrom chanical Drive System Problems During the Design Process"; IEEE Trans. Ind. Appl. Vol. 1A-20, No. 4, Jul.-Aug. 1984, pp. 873-880; 5 Refs.; ISSN 0093-9994; ITIAC

1 - Grinding Mills - Electric Drive; Electromechanical Drive System Problems; Problem Elimination; Design Process A533; A802; A705

This paper describes detailed electromechanical system studies made on the drive of a 6000-HP dual-pinion grinding mill powered by wound rotor induction motors with liquid rheostat secondary controller. A number of torsional resonant vibration as well as control strategy problems were identified and actions taken to minimize the torsional vibrations from resonating at frequencies and amplitudes, which would cause component damage and ultimate failure.

GRINDING (iv) WEAR AND LINERS

2170.10 Kayun, G.D.; Zaskavskii, Yu.I.; Evtushenko, A.I.; Kartashev, A.L.V.; Perepelitsa, S.S. (USSR (SU)), "Use of Silicon Carbide for Protection of Equipment of Ore-Dressing Plants Against Wear"; Obagashch, Rud. (Leningrad), Vol. 28, No. 2, 1983, pp. 36-38; ISSN 0029-7623; OBOGA

CA157007; Silicon Carbide Lining Ore Beneficiation, Iron Ore Benefication Lining Wear

Separators, Linings, Iron Ores, 409-21-2

2170.42 Sudarshan, T.S.; Bhaduri, S.B. (Viriginia Polytechnic Inst. & State Univ., Dept. of Materials Engineering, Blacksburg, VA, USA), "Wear in Cylinder Liners"; Wear, Vol. 91, No. 3, Nov. 15, 1983, pp. 269-279; 14 Refs.; ISSN 0043-1648; WEARA

1 - Cylinders - Wear; Surfaces - Grinding; Corrosion - High Temperature Effects A601; A421; A604; A539

Investigators have extensively studied various aspects of wear in cylinder liners but a survey of the literature has revealed little information on the subject of high wear rates found in the upper portion of the liners. In order to provide a better under-standing of the subject, an attempt is made in this paper to assess the primary factors responsible for the high wear rates. It is observed that, although several factors can operate at the same time in influencing the wear process, in general wear is controlled by adhesion with contributions later on from corrosive and abrasive processes. The metallurgy of the liner also plays an important role in determining wear rates.

2170.56 Moroz, P.J., "The Effects of Matrix Hardness and Microstructure on the Wear of Grinding Balls During Wet Iron Ore (Magnetite) Grinding"; Intermountain Minerals Symposium,

1982, pp. 63-77; Held: Vail, Colo., 3-6 Aug. 1982; Pub: Climax Molybdenum Co. of Michigan, 1600 Huron Parkway, P.O. Box 1568, Ann Arbor, Mich. 48106

31, Chromium Molybdenum Steels, Mechanical Properties, Iron Ores, Beneficiation, Ball Mills, Wear Resistance, 4140, SACM

The wear behaviour of 0.90 C carbon steel and AISI 4140 grinding balls used in the wet grinding of iron ore was studied. Microstructure is the dominant factor in controlling wear resistance. If tempered martensite (really tempered martensite-retained austenite) microstructures are compared, hardness is a good indication of wear resistance, increasing hardness, then leads to increased wear resistance. Wear rates of mixed martensite-pearlite/bainite microstructures increased linearly as the percent martensite decreased from 100 to 70%. The effective hardness of an abrasive system determined from tempered moly-cop balls can be used as an index of the severity of the grinding operation. 20 Refs.

2215 Vermuelen, L.A.; Howat, D.D.; Gough, C.L.M. (Council for Mineral Technology (MINTEK), Randburg, S. Afr.), "Theories of Ball Wear and the Results of a Marked-Ball Test in Ball Milling"; J. S. Afr. Inst. Min. Metall., Vol. 83, No. 8, Aug. 1983, pp. 189-197; 4 Refs.; ISSN 0038-223X; JSAMA

1 - Grinding Mills - Ball Miling A533; A911

In a test conducted at the Markiana Mine of Western Platinum Limited, six grades of marked balls, one of which was identical to the background charge, were introduced simultaneously into a mill. Formulae expressing the dependence of the mass of a grinding ball on the amount of material milled are derived. With the aid of these formulae, it is relatively simple for the results of a marked-ball test to be analyzed and for the relative performance and cost-effectiveness of various types of ball to be evaluated.

2223 Natarajan, K.A.; Reimer, S.C.; Iwasaki, I. (Univ. Minnesota, Mineral Resources Res. Ctr. Minneapolis MN 55455), "Influence of Pyrrhotite on the Corrosive Wear of Grinding Balls in Magnetite Ore Grinding"; International Journal of Mineral Processing, Vol. 13, No. 1, 1984, pp. 73-81, Ref: 005

2234 Noguchi, H.; Tamakohri, K. "A Newly Developed In-Process Sensor for Measuring Wear of Grinding Wheel Using Twin Air Nozzles"; Journal of Mechanical Engineering Laboratory, Vol. 38, No. 2, 1984, pp. 34-35; Ref: 000

2249 Coles, H.R.; Chong, S.P. (Iron Ore Co. of Canada, Labrador City, Newfoundland, Can.); "New Liner Design Improves

Aerofall Mill Throughput"; Min. Eng. (Littleton, Colo.), Vol. 35, No. 11, Nov. 1983, pp. 15556-1560; 2 Refs.; ISSN 0026-5187; MIENA

1 - Iron Ore Treatment - Crushing and Grinding A533

Test work conducted in the 6.4 and 10.5 m (21 and 34 ft) Aerofall Mills at the Iron Ore Co. of Canada Carol Project showed that conventional deflector type lines did not necessarily provide the best grinding performance. A new design, using low profile liners incorporating radial ribs of proper height, improved mill throughout 9-20P without sacrificing efficiency. In addition, the new design reduced liner weight and scrap losses, resulting in a 25P reduction in liner consumption. It provided better protection to the mill shell and reduced maintenance cost.

2261 Vocel, M.; Voborol, J.; Kulik, V., "Wear of Milling Members in Milling of Abrasive Materials" (Translation No. VR/2222/82); Strojirenstvi, 1982, Vol. 32, No. 12, pp. 14; IBSN: ISSN 0039-2464

42, Ball Mills, Chromium Iron, Mechanical Properties, Carbon Steels, Wear Resistance

1984 (D) CLASSIFICATION

2203 Slechta, J.; Firth, B.A. (Cent. Res. Lab., BHP, Shortland, Austrlia, 2307 (AU)), "Classification of Fine Coal with a Hydrocyclone"; Int. J. Miner. Process., Vol. 12, No. 4, 1984, pp. 213-237; ISSN 0301-7516; IJMPB

CA15107; Coal Classification Hydrocyclone

Coal

2218 Menden, G., "Filtering Separators Without Preseparators in Grinding Plants in the Rock and Clay Industry/ Filternde Abscheider Onhe Vorabscheider in Mahlanlagen der Steine - Und Erden-Industrie"; Aufbereit Tech. Vol. 25, No. 2, Feb. 1984, pp. 102-108; 8 Refs.; ISSN 0004-783X; AUFTA

1 - Crushed Stone Plants - Separators; Separation - Filtration A412; A802

Filtering separators for direct separation of the whole mill output have proved successful in coal grinding and drying plants in the cement industry. The design criteria for determination by the practician of the specific air-to-cloth ratio possible are discussed. Particular attention is paid

to the influence of the particle size spectrum and the dust load in the raw gas. The possible effect of a presentation on a filtering separator is explained by an example. The development and design of these special filtering separators are elucidated as well as important criteria regarding the needle-felt-based filtering media to be used. Finally, design data and operating results are presented for a number of constructed systems for various applications. In German and English.

2220 Slechta, J.; Firth, B.A. (BHP, Central Research Lab., Shortland, N.S.W., Aust.), "Classification of Fine Coal with a Hydrocylone"; Int. J. Miner. Process., Vol. 12, No. 4, Apr. 1984, pp. 213-237; 21 Refs.: ISSN 0301-7516; IJMPB

1 - Coal Preparation - Classification; Chemical Equipment - Cyclones A524; A802

The classification performance of a 225-mm hydrocyclone has been investigated. Coal slimes of a nominal 0.5 mm size consist were classified in the separation-range of 0.070 mm to 0.250 mm at solids contents from 6 to 35p by mass, and flow rates of 200 to 700 l Min**-**1. The partition curves obtained were analyzed in terms of the water split to the oversize flowstream, the corrected separation size and the reduced partition curve. The solids content of the slurry was the major factor in determining the partition curve.

2221 Seitz, R.A.; Kawatra, S.K. (Michigan Technological Univ. Dept. of Metallurgical Engineering, Houghton, Mich. USA), "Further Studies on the Use of Classifiers for the Control of Wet Grinding Circuits"; Int. J. Miner. Process., Vol. 12, No. 4, Apr. 1984, pp. 239-249; 18 Refs.; ISSN 0301-7516; IJMPB

1 - Ore Treatment - Classifiers A533; A921

An analytical development is presented which yields a general inferential sizing model relating circuit product size to D/5/0 corrected for the circuits' classifier. It is shown how the different forms of empirical equations reported in the literature can arise, depending on the range of the operating variables and the ratio of feed 50p passing size to D/5/0 corrected. The data show that pilot plant and industrial plan operations behave as predicted.

2222 Laplante, A.R.; Finch, J.A. (McGill Univ. Dept. Min. & Met. Engn., Montreal, H3A 3A7, Quebec, Canada), "The Origin of Unusual Cyclone Performance Curves"; International Journal of Mineral Processing; Vol. 13, No. 1, 1984, pp. 1-11; Ref: 009

2225 Balagur, Y.A.; Ermolin, Y.N. (Acad. Sci. USSR, Inst. Min. Novosibirsk, USSR), "Control of Fragment Size in Using

Methods for Large-Fragment Separation of Ores"; Soviet Mining Science, USSR, Vol. 19, No. 4, 1983, pp. 281-284; Ref: 011

2228 Kumar, D., "Pneumatic Classifier and its Application for Beneficiation of Phosphate Rocks/Ein Luftstrom-Klassierer und seine Anwendung zur Aufbereitung von Phosphatgestein"; Aufbereit Tech., Vol. 25, No. 2, Feb. 1984, pp. 88-90; ISSN 0004-783X; AUFTA

1 - Phosphate Ore Treatment - Classifiers A533

This article gives a brief description of the pneumatic classifier which is in operation in the semidesert region of North Africa for beneficiation of phosphate rocks. Because of acute shortage of water, there is no other way but to resort to this dry process which is not as efficient as the wet process. However, after conducting a performance study, it was revealed that imperfection of the machine is 0.17 and the separation range is 120 "MU" to 125 "MU". It is concluded that this machine can be used by itself in the case of high-quality phosphate rocks and in conjunction with other methods in the case of lower-quality phosphate. Under similar conditions, it can also be employed in the preparation of other minerals. In German and English.

2235 Rivkinzon, I.B.; Zyuba, B.I. (Grozny Petr. Res. Inst, Grozny, USSR), "New Trends in the Improvement of Cyclones"; Chemistry and Technology of Fuels and Oils, Vol. 19, No. 9-10, 1983, pp. 504-508; Ref.: 004

2237 Svekrov, V.M.; Torpov, P.F. (Kuznetsk Met. Ind., Kuzneitsk, USSR), "Mechanization of Cinder Removal From Blooming-Mill Soaking Pits"; Metallurgist, Vol. 27, No. 11-1, 1983, pp. 378-379; Ref.: 000

2241 Trasi, P.R., Light, W. (Univ. Cincinnati, Dept. Chem. & Nucl. Engn., Cincinnati, OH 45221), "Effect of Recycle on Cyclone Performance"; Industrial and Engineering Chemistry Process Design and Development, Vol. 23, No. 3, 1984, pp. 479-482; Ref.: 010

2255 Schneider, K.T.; Eickholt, H.; Blasczyk, G., "Influence of Separators on Grinding Systems - Operating Results/Einfluss von Sichtern auf Mahlanlagen"; Zement Kalk Gips, Ed. B, Vol. 36, No. 12, Dec. 1983, pp. 676-684; ISSN 0733-4400; ZKGBD

1 - Cement Handling - Grinding; Separators - Pneumatic; Centrifuges - Performance; Separation Systems A412; A691; A802

After outlining the aim of the separating process, the paper describes one separator operating statically in the airstream

and three dynamic separators with their own fans. Operating results show the influence of various separation systems on the grinding performance. These different systems are compared, their preferred area of application is outlined and their advantages and disadvantages are discussed. In German with English abstract.

2338 Kuga, Yoshikazu; Koga, Jiro; Yamachuchi, Kenji; Kim, Chul (Ed.); Ihm, Son Ki (Ed.), "Size Distibution of the Product of a Screen Mill"; Proc.-Pac. Chem. Eng. Congr., 3rd, Vol. 1, 1983, pp. 75-80; 52CTA; Pub: Korean Inst. Chem. Eng., Seoul, S. Korea

CA148003; Screen Mill Product Size Distribution, Comminution Impact Mill Size Distibution

Size Reduction

2405 Anon., "How Do You Keep Screens Running Efficiently?"; Pit Quarry, Vol. 76, No. 12, June 1984, pp. 52-56; ISSN 0032-0293; PIQUA

1 - Screens and Sieves - Maintenance A605; A405; A502

The article discusses installation, maintenance and operating factors of vibrating screens.

2407 Biffin, M.; Syred, N.; Sage, P. (Dept. Mech. Eng. Energy Stud., Univ. Coll., Cardiff, UK, CF2 1TA (GB)), "Enhanced Collection Efficiency for Cyclone Dust Separators"; Chem. Eng. Res. Des., Vol. 62, No. 4, 1984, pp. 261-265; ISSN 0263-8762; CERDE

CA148001; Dust Separator Cyclone

Dust, Separators

2409 Mothes, H.; Loffler, F. (Univ. Calif. Berkeley, Dept. Chem. Engn., Berkely, CA 94720; Univ Karlsruhe, Inst. Mech. Verfahrenstech & Mech., D-7500, Karlsruhe 1 Fed. Rep. Ger.), "Motion and Deposition of Particles in a Cyclone"; Chemie Ingenieur Technik., Vol. 56, No. 9, 1984, pp. 714-715; Ref: 004

2413 Kanau, J.L., "Mill Operators' Conference North West Queensland, Australia, Sept. 1982), "Hydrocyclone Research and Development at Bougainville Copper Limited"; Australasian Institute of Mining and Metallurgy, Clunies Ross House, 191 Royal Parade, Parkville, Victoria, Australia 3052 (1982), pp. 169-177; See: 8411-72-0720

41, Copper Ores, Beneficiation, Classification (Centrifugal), Hydrocylones

The developments in hydrocyclone classification in the milling circuit at Bougainville Copper Limited are discussed. A major change in cyclone size and improvements in operating conditions have been made. Test work has been carried out to assess the classification performance of modified linatex cyclone. Wemco cyclones and a two stage cycloning circuit. The use of a scalping cyclone, to remove coarse material from the present overflow product for regrind, has also been investigated. 8 Refs.

2418 Kuhlmann, K. (Forschungsinst Zementind, Dusseldorf, Fed. Rep. Ger.), "Significance of Classification in Cement Grinding - Results of a Balance Analysis of the Grinding Circuit"; Zement Kalk Gips, Vol. 37, No. 1984, pp. 474-480; Ref: 000

2421 Williamson, R.D.; Bott, T.R.; Kumar, H.S.; Newson, I.H. (Univ. of Birmingham, Birmingham, Eng.), "Use of Hydrocyclones for Small Particle Separation"; Sep. Sci. Technol., Vol. 18, No. 12-13, Sept.-Oct. 1983, Symp. on Sep. Sci. and Technol. for Energy Appl., 3rd, Gatlinburg, Tenn, USA, June 28-July 1, 1983, pp. 1395-1416; 19 Refs.; ISSN 0149-6395; SSTED

1 - Separators; Chemical Equipment - Cyclones A802; A482

Hydrocyclone operating characteristics have been studied by measuring the capacity for separating haematite, magnetite and silica particles suspended in water. The effects of viscosity (achieved by changing temperature) and throughput have been investigated and are satisfactorily correlated. The measurements demonstrate that under appropriate conditions of high pressure drop and low viscosity, particles below the usually accepted limit of 2 "MU" m can be separated. Measured particle separation is expressed as a hydrocyclone efficiency, and its variation with particle size is shown. Anomalous results with magnetite and haematite suspensions are suggested to occur because these materials exist as agglomerates with effective density less than half that of the bulk material.

2426 Irvine, R.A. (C-E Tyler, Montor, Ohio, USA), "Large Vibrating Screen Design - Manufacturng and Maintenance Considerations"; Min. Eng. (Littleton, Colo.), Vol 36, No. 9, Sept. 1984, pp. 1341-1346; 1 Ref.; ISSN 0026-5187; MIENA

1 - Screens and Sieves - Vibrating A605; A502

The design of vibrating structures that span large unsupported distances is critical to the reliability of a

screen subjected to billions of fatigue cycles. Larger percentages of total plant production become dependent on fewer, larger vibrating screens. Plant designers and operators can plan for equipment maintenance in a manner which optimizes the production availability of large vibrating screens.

2429 Schmidt, P.; Wesselbaum, F.-J.,"Screening Capacity of Vibrating Screens/Die Siebleistung von Schwingsieben"; Aufbereit Tech., Vol. 25, No. 7, July, 1984, pp. 380-384; 4 Refs.; ISSN 0004-783X; AUFTA;

1 - Screens and Sieves - Vibrating A605; A802

By applying relationships and data based on similarity theory concerning the behavior of disperse materials, it is possible to draw inferences as to specific screening capacity. In this way, by means of tests on screens with throwing action and with in-plane oscillating action, diagrams have been established which indicate the specific screening capacity as a relation between the dimensionless froude number, the screen characteristic and the diameter/mesh ratio. In German and English.

2442 Onuma, E.; Furukawa, T. (Onuda Cement Co. Ltd., Div. Cement & Concrete, Cent. Res. Lab., Tokyo, Japan), "On the Criteria for the Assessment of Performance Quality of a IR Classifiers in Closed-Circuit Tube-Mill Systems"; In: Iinoya, K.; Beddow, J.K.; Jimbo, G., Powder Technology, 1984, pp. 412-419; Ref.: 000; Pub: Hemisphere Publ. Corp., 1025 Vermont Ave. N.W., Washington, DC 2005

International Symp. on Powder Technology, Held: Kyoto, Japan 81-9-28--10-1

LC: 83-18641 ISBN: 0-89116-285-2

2265 Davis, P.K. (Southern Illinois Univ. at Carbondale, Dept. of Engineering Mechanics and Materials, Department of Energy, Washington, DC), "Flow and Design Characteristics of the Hydrocyclone for the Recovery of Coal Fines, Final Report"; DE 84009968, March 84, 327 p. (DOE/PC/40807-T10)

2341 Colussi, Iginio; Dalla Torre, Alberto; Dessenibus, Armando; Preti, Ugo (Ist. Chim. Appl. Ind., Univ. Trieste, Trieste, Italy, (IT)), "Optimum Experiment Design for the Modelling of Hydrocyclone Separators"; Proc. Austrian-Ital.-Yugosl. Chem. Eng. Conf., 3rd, Vol. 2, 1982, pp. 742-755; 51SAA; Pub: Tech. Univ. Graz., Graz, Austria

CA148001; Expt. Design Hydrcyclone Separator Modelling

Separators, Statistics and Statistical Analysis

1984 (E) THEORY, KINETICS, MODELLING, FRACTURE

2170.07 Laplante, A.R.; Redstone, J. (McGill Univ., Dept. Mines & Met., Montreal, H3A 2T5, Quebec, Canada; Camchib Mines Inc., Div. Asbestos, Montreal, Quebec, Canada), "Modelization of the Grinding of Hematite Concentrates at Sidbec-Normines"; CIM. Bulletin, Vol. 76, No. 860, 1983, pp. 67-73; Ref: 013

2170.19 Voller, V.R. (Sch. Math. Stat. Comput. Thames Polytech., London, UK, SE1 86PF (GB)), "A Note on Energy-Size Reduction Relationships in Comminution"; Powder Technol., Vol. 36, No. 2, 1983, pp. 218-286; ISSN 0032-5910; POTEB

CA148003; Size Redn. Energy Relation

Size Reduction, Energy

2170.44 Hogg, R. (Penn. State Univ., Dept. Mineral Engn. Mineral Proc. Sec. University Pk., PA 16802), "Mass-Transport Models for Tumbling Ball Mills"; In: Herbst, J.A. Control 84: Mineral/Metallurgical Processing, 1984, pp. 55-61; Ref: 000; Pub: Soc. Min. Engineers AIME; Caller No. D; Littleton, CO 80127; 1st International Symp. on Automatic Control in Mineral Processing and Process Metallurgy. Held: Los Angeles, CA, 84-2-26--3-2

LC: 83-73511 ISBN: 0-89520-420-7

2170.48 Austin, L.G.; Klimpel, R.R. (Penn. State Univ., Dept. Mineral Engn. Mineral Proc. Sec. University Pk., PA 16802), "Modeling for Scale-up of Tumbling Ball Mills" In: Herbst, J.A. Control 84: Mineral/Metallurgical Processing, 1984, pp. 55-61; Ref: 000; Pub: Soc. Min. Engineers AIME; Caller No. D; Littleton, CO 80127; 1st International Symp. on Automatic Control in Mineral Processing and Process Metallurgy. Held: Los Angeles, CA, 84-2-26--3-2

LC: 83-73511 ISBN: 0-89520-420-7

2170.57 Wong, W.C.K.; Middleton, D. (Papua New Guinea Univ. Technol. Dept. Mech. Engn., LAE, Papua New Guinea), "On the Estimation of Parameters for a Nonlinear Model of a Milling Process"; International Journal of Production Research, Vol. 22, No. 2, 1984, pp. 247-252; Ref: 000

2170.68 Eda, H.: Kishi, K; Ueno, H. (Utsunomiya Univ., Fac. Engn. Dept. Mech. Engn. Utsonomiya Tochigi 321, Japan), "Cracking and Fracture of Matrix Structure and Carbide Particles Produced by the Grinding Process"; Precision Engineering, Vol. 5, No. 2, 1983, pp. 73-76; Ref: 000

2227 Allam. M.M.; Sridharan, A. (Indian Inst. of Science, Bangalore, India), "Shearing Resistance of Saturated Clays"; Geotechnique, Vol. 34, No. 1, March 1984, pp. 119-122; Refs.; ISSN 0016-8505; GTNQA

1 - Clay - Shear Strength; Dielectric Properties - Monitoring; Particle Size Analysis A483; A701; A941

As a result of isomorphous substitution taking place in the lattice structure during formation, clay minerals possess a charge deficiency on their surfaces which is usually negative. When the voids in a mass of clay particles are filled with water or any fluid, two possible extreme configurations of the particles can be visualized. In the first configuration, the particles are randomly oriented and each makes at least one edge-face contact with its nearest neighbor. This configuration can be described as the contact model. In the second configuration, the particles are oriented parallel to one another and no interparticle contact exists. This configuration can be called the non-contact or parallel plate model. This model is used for explaining the volume-change behavior of clay systems.

2229 Bazant, Zdenek, P. (Northwestern Univ., Cent. for Concrete & Geomaterials, Evanston, Ill. USA), "Size Effect in Blunt Fracture: Concrete, Rock, Metal"; J. Eng. Mech., Vol. 110, No. 4, Apr. 1984, pp. 518-535; 40 Refs.: JENMD

1 - Fracture Mechanics; Materials Testing - Fracture; Concrete - Fracture; Rock - Fracture; Metals and Alloys - Fracture; Microcracking A931; A421; A412; A483; A531

The fracture front in concrete, as well as rock, is blunted by a zone of microcracking, and in ductile metals by a zone of yielding. This blunting causes deviations from the structural size effect known from linear elastic fracture mechanics (LEFM). The size effect is studied first for concrete or rock structures, using dimensional analysis and illustrative examples. The size effect is shown to consist in a smooth transition from the strength criterion for small sizes to LEFM for large sizes, and the nominal stress at failure is found to decline according to an expression, given in the paper, that involves the relative structure size. Exploiting the fact that in metals the size of the yielding zone at the fracture front is approximately constant, it is

shown by dimensional analysis that elastic-plastic fracture causes a similar size effect.

2239 Bazant, Z.P.; Oh, B.H. (Northwestern Univ., Inst. Technol.Ctr Concrete & Geomat, Evanston, IL 60201; Northwestern Univ. Dept. Civil. Engn., Evanston, IL 60201; Portland Cement Assoc., Skokie, IL 60077), "Rock Fracture Via Strain-Softening Finite-Elements"; Journal of Engineering Mechanics-ASCE, Vol. 110, No. 7, 1984, pp. 1015-1035; Ref.: 046

2251 Klimpel, R.R.; Austin, L.G. (Dow Chemical Co., Midland, MI, USA (US)), "The Back-Calculation of Specific Rates of Breakage from Continuous Mill Data"; Powder Technol., Vol. 38, No. 1, 1984, pp. 77-91; ISSN 0032-5910; POTEB

CA148003; Grinding Breakage Rate Backcalcn.

Size Reduction

2252 Lytle, J.M.; Prisbrey, K.A. (Battelle, Pacific Northwest Lab, Richland, Wash., USA), "Material-Dependent Non-Linear Modelling of Fine Coal Grinding"; Powder Technol., Vol. 38, No. 1, March-April 1984, pp. 93-97; 12 Refs.: ISSN 0032-5910; POTEB

1 - Coal Preparation - Breakage; Crushing and Grinding - Mathematical Models A524; A802; A921

Fine grinding of lignite in a ball mill was shown to be nonlinear in rate because of the presence of both weaker and stronger organic phases. Weaker phases were ground rapidly, whereas stronger phases were ground more slowsly. Lignite grinding was modelled by evaluating two sets of time-independent linear breakage rate constants, one for the weaker phases and one for the stronger phases. The time of transition when the comminution rate became controlled by the stronger phases rather than the weaker phases was determined by observing changes in gas release rate and particle properties such as composition, shape and porosity.

2340 Mizonov, V.E.; Shuvalov, S.I.; Ushakov, S.G.; Dorzhiev, M.N., "Mathematical Model of Grinding"; Tsvetn. Met. (1984), (1) 92-94; ISSN 0041-4891

41; Grinding (Comminution); Mathematical Models

A mathematical model is developed on the basis of the concept of selective grinding, making it possible to describe steady-state conditions and transient processes of grinding in tumbling barrels with minimal empirical information. Testing checking of the model confirmed its satisfactory accuracy.

2402 Austin, L.G.; Luckie, P.T.; Rogers, R.S.C.; Brame, K.; Shoji, K. (Pennsylvania State Univ., Dept. of Mineral Engineering, University Park, PA USA), "Simulation Model for an Air-Swept Ball Mill Grinding Coal"; Powder Technol., Vol. 38, No. 3, July 1984, pp. 255-266; 16 Refs.; ISSN 0032-5910; POTEB

1 - Coal Preparation - Crushing and Grinding; Grinding Mills - Mathematical Models; Tumbling Ball Mills; Air Sweeping A524; A802; A921

The simulation of tumbling ball mills with mathematical models has reached a fairly advanced stage, but the concepts have not been applied to coal grinding because the models have not included the effect of air-sweeping. In this paper, the models are modified to allow for air-sweeping, assuming that the removal of fines allows the fracture to proceed in a first-order manner. The characteristics of an air-swept ball mill is that the entire flow of powdered coal from the mill is in the air stream. The model incorporates closed circuit via an external classifier and the simulation is validated by tests on a pilot-scale mill.

2408 Gardner, R.P.; Aissa, M.; Verbhese, K. (Cent. Eng. Appl. Radioisito., North Carolina State Univ., Raleigh, N.C. USA 27695 (US)), "A Model with Closed-Form Analytic Solution for Steady-State, Closed-Circuit, Linear Comminution Processes Based on the Cross-flow, Finite-Stage Residence Time Distribution Model"; Powder Technol., Vol. 38, No. 1, 1984, pp. 143-145; ISSN 0032-5910; POTEB

CA148003; Comminution Math Modelling

Size Reduction

2416 Kinneberg, D.J.; Herbst, J.A. (Univ. of Utah, Dept. of Metallurgy & Metallurgical Engineering, Salt Lake City, Utah, USA), "Comparison of Linear and Nonlinear Models for Open-Circuit Ball Mill Grinding"; Int. J. Miner. Process., Vol. 13, No. 2, Aug. 1984, pp. 143-165; 24 Refs.: ISSN 0301-7516; IJMPB

1 - Grinding Mills - Ball Milling A533

A comparison is made of the capability of population balance models to predict steady-state product size distributions of a pilot-scale ball mill operated at 60p solids with feed rates of limestone ranging from 90 to 450 kg/hr (200 to 1000 lb/hr). Two types of lumped parameter models are compared: a linear model in which size reduction parameters are independent of size and a nonlinear model in which these parameters are dependent on size. The nonlinear model gives

the most accurate predictions of production size distributions.

2420 Venkataraman, K.S.; Fuerstenau, D.W. (Dept. Mater. Sci. Miner. Eng., Univ. California, Berkeley, CA, USA (US)), Powder Technolog., Vol. 39, No. 1, 1984, pp. 133-142; ISSN 0032-5910; POTEB

CA148003; Grinding Mineral Mixt. Population Balance

Size Reduction, Energy

2431 Laplante, A.R.; Redstone, J. (McGill Univ., Dept. of Mining & Metallurgical Engineering, Montreal, Que. Can), "Modelling of Grinding Kinetics at the Sidbec-Normines Port-Cartier Pelletizing Plant"; Miner. Metall. Process, Vol. 1, No. 2, Aug. 1984, pp. 143-149; 20 Refs.; MMPRE A533, A802; A921

1 - Iron Ore Treatment - Crushing and Grinding; Crushing and Grinding - Mathematical Models; Pelletizing; Grinding Mills - Ball Milling; Concentrate Regrinding; Slurry Short Circuiting; Breakage Kinetics; Residence Time Distributions; Lumped Parameter Size Discrete Model

Treat: T (Theoretical)

Sidbec-Normines' pelletizing plant, located in Port Cartier, Quebec, operates six large ion ore concentrate regrinding ball mills in parallel and open circuit. Grinding kinetics in these mils were characterized for slurry densities varying between 70 and 89p solids, using a lumped parameter size discrete model. Optimum grinding conditions were encountered at 83.5 to 84p solids. Higher densities decreased the normalized selection function and increased slurry short-circuiting, yielding a sharply coarser mill discharge. At lower slurry densities, the normalized selected function decreased and the mill discharge coarsened slightly. The grinding kinetic model predicted particle size distributions within the mill. These were found to vary significantly from the feed to the discharge end. This is likely to cause nonlinear breakage kinetics.

1984 (F) PROCESS ANALYSIS, EFFECTS

2170.00 Steenberg, B. (Royal Inst. Technol., Dept. Paper Technol. S-10044 Stockholm 70 Sweden), "Wet Milling - A Model Based on Hydrodynamics and Particulate Media Mechanics"; Powder Technology, Vol. 37, Jan. 1984, pp. 289-297; Ref: 014

2170.23 Somasundaran, P.; Elshall, H. (Henry Krumb Sch. Mines, New York, NY 00000), "Mechanochemical Effects in Ultrafine Grinding"; In: Malaghan, S.G., Ultrafine Grinding and Separation of Industrial Minerals at the 112th Meeting of the American Inst. of Mining, Metallurgical and Petroleum Engineers. Held: Atlanta, GA, 83

LC: 83-82078 ISBN: 0-89520-419-3

2170.28 Cohen, S.M. (Fuller Co. Bethlehem. PA, 00000), "Upgrading of Clay Deposit by Selective Grinding and Air Classification for Use in Portland-Cement Manufacture"; In: Malaghan, S.G., Ultrafine Grinding and Separation of Industrial Minerals, 1983, p. 87; Ref: 000; Pub: Soc. Min. Engineers AIME: Caller No. D; Littleton, CO 80127;

Sessions on Ultrafine Grinding and Separation of Industrial Minerals at the 112th Meeting of the American Inst. of Mining, Metallurgical and Petroleum Engineers. Held: Atlanta, GA, 83

LC: 83-82078 ISBN: 0-89520-419-3

2170.29 Lytle, John M., Daniel, J. Leland, Tingey, Farth L. (Pacifici Northwest Lab., Richland, Wash, USA),"Concentration of Sulphur and Mineral Rich Components in Particle Classes during Coal Comminution"; Fuel, Vol. 62, No. 11, Nov. 1983, pp. 1299-1303; 14 Refs; ISSN 0016-2361; FUELA

1 - Coal Preparation - Crushing and Grinding A524

Particle-by-particle compositional analyses, using scanning electron microscopy and quantitative X-ray fluorescence, of lignite comminutes at 20° C in helium showed that during milling a more porous component was ground more rapidly than a less porous component, so that a bimodal distribution of coal mass versus particle sizre was observed. The finer material that intially was the more porous component had significantly less organic sulphur and aluminium and more inorganic sulphur than the coarser, less porous component after seven hours of comminution.

2170.30 Lytle, John. M., Daniel, J. Leland, Prisbrey, Keith A. (Battelle, Pacific Northwest Lab., Richland, Wash., USA), "Effect of Microstructure on the Size and Shape of Coal Particles during Comminution"; Fuel, Vol. 62, No. 11, Nov. 1983, pp. 1304-1309; 5 Refs; ISSN 0016-2361; FUELA

1 - Coal Preparation - Crushing and Grining A524

Coal samples were comminuted in a ball mill under controlled temperature, in helium. Microstructural analyses of the coal

particles before ball milling and at various times during milling showed relationships between the microstructure and the size and shapes of the resulting particles. During milling, fracture lines tended to proceed through pores and cracks and organic-to-organic and mineral-to-organic interfaces, and thus these features greatly influenced the size and shapes of particles produced. In the early stages of milling, a porous component of lignite produced needle-like or plate-shaped particles that were later broken into blocky and rounded particles.

2170.32 Zhuravlev, V.I., Glushchenko, I.M., Bychev, M.I., Malevich, V.K. (Kommunar Mining & Metallurgical Inst., Stakhanov Branch, USSR), "Investigation of the Degradation Products of Coals with Different Degrees of Grinding by Mass Spectrometry"; Solid Fuel Chem., Vol. 18, No. 3, 1983, pp. 32-38; 15 Refs; ISSN 0361-5219; SFCHD

1 - Coal - Degradation; Coal Preparation - Crushing and Grinding; Spectroscopy; Mass Spectrometers - Applications; Chemicals - Chemistry A524; A533; A801; A804; A943

The products of mechanodegradation and thermal degradation passing into the vapor phase from coal particles of different degrees of grinding have been investigated by the method of thermal-destructive mass spectrometry. The group chemical compositions of these products have been identified. With a decrease in the grain size of the coal particles, a quantitative redistribution of the hydrocarbons in favor of aromatic structures and those close to them with respect to the degree of hydrogen unsaturation takes place in the products of their thermal degradation passing into the vapor phase in vacuum. The distribution of hydrocarbons within their homologous series scarcely depends on the degree of grinding of the coals in the range of grain sizes studied.

2170.53 Morales, J., Tirado, J.L. (Univ. Cordoba, Fac. Ciencias, Dept. Quim. Inorgan. Cordoba, Spain), "Thermal Effects Induced by Grinding in Dolomite"; Materials Chemistry and Physics, Vol. 10, No. 3, 1984, pp. 225-235; Ref: 016

2200 Braun, D.J. (Vereinigte Aluminium Werke Ag, Leichtmetall Forschungsinst D-5300 Bonn 1 Italy); "Attrition of Aluminas"; In: McGeer, J.P., Light Metals 1984, pp. 257-268; Ref: 000; Pub: Metallurgical Soc. of AIME, 345 E 47th St, New York, NY, 10017

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LC: 72-623660 ISBN: 0-89520-470-3

2207 Jarvis, J.E. (Torrance & Sons Ltd., Bristol, England), "Some Aspects of Wet Milling Coal-Liquid Slurries"; In: Inst. Chem. Engineers. Coal Liquid Mixtures, 1983, pp. 75-84; Ref: 000; Pub: Inst. Chemical Engineers, George E. David Bldg, 165-171 Railway Terrace, Rugby, CV21 3HG, UK

1st European Conf. on Coal Liquid Mixtures, Held: Cheltenham, England 83/10/5-6

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ISBN: 0-85295-162-0

2245 Polushkin, A.N., Kostomarova, M.A., Surinova, S.I. (Inst. of Combustible Minerals, USSR), "Influence of the Grinding of Coal on the Density of Coal Granules of Spherical Form"; Solid Fuel Chem., Vol. 17, No. 2, 1983, pp. 100-105; 8 Refs; ISSN 0361-5219; SFCHD

1 - Coal Preparation - Crushing and Grinding; Granulated Materials - Density Measurement; Mathematical Techniques; A524; A921; A931

In the reported experiments, the optimum parameters for grinding coal which ensure the production of dense and strong granules have been determined: specific surface 6800-7900 CM**2/G: yield of fractions with dimensions less than 50 "MU" M greater than 90P. It has been shown that overgrinding the coal leads to the aggregation of the individual particles, preventing the normal growth of granules. A calculation has been performed of the densest packing of the particles in a granule and a comparison has been made of the calculated and experimental results.

2253 Gomizvillacieros, R., Morales, J., Tirado, J.L. (Univ. Cordoba, Fac. Ciencias, Dept. Quim. Organ. Cordoba, Spain), "Mechanical Dehydration of Gamma-FeOOH by Wet Grinding Procedures; Journal of the Chemical Society-Chemical Communications, No. 8, 1984, pp. 559-560; Ref: 005

2254 Morozov, Yu P., Semidalov, S. Yu, Koryukin, B.M., Al'tdinov, R.M., Topaev, G.D. (USSR (SU)), "Effect of Hardness Reducers on the Efficiency of Grinding Sulfide Ores"; Tsvetn. Met. (Moscow), No. 2, 1984, pp. 93-95; ISSN 0372-2929; TVMTA

CA154001; Sulfide Ore Grinding Sodium Chloride, Aluminum Iron Chloride Ore Grinding

Ore Treatment, 7647-14-5; 7705-08-0; 7446-70-0

2300 Natarajan, K.A., Iwasaki, I. (Univ. of Minnesota, Mineral Resources Research Cent., Minneapolis, Minn., USA), "Electrochemical Aspects of Grinding Media - Mineral Interactions in Magnetite Ore Grinding"; Int. J. Miner. Process, Vol. 13, No. 1, June 1984, pp. 53-71; 11 Refs; ISSN 0301-7516: IJMPB

1 - Iron Ore Treatment - Crushing and Grinding; Grinding Mills - Ball Milling A533; A539

Electrochemical aspects of grinding media-mineral interactions are illustrated from the viewpoint of corrosive wear of grinding balls and changes in surface properties of the ground minerals. The corrosive wear of mild steel and HCLA steel was small in contact with magentite, while the combined presence of pyrrhotite and oxygen accelerated corrosion. Austenitic stainless steel exhibited passive behaviour under all conditions. Galvanic coupling of mild steel with magnetite or pyrrhotite resulted in the formation of a surface reaction product consisting of iron hydroxide.

2314 Pandev, P.C.; Mehta, N.K. (Univ. Roorkee, Dept. Mech. & Ind. Engn., Roorkee, 247672, Uttar Pradesh, India), "Application of Design of Experiment Technique to Milling Operation Studies"; Indian Journal of Technology, Vol. 22, No. 3, 1984, pp. 93-98; Ref: 000

2329 Hoberg, Heinz, Schneider, Fred Ulrich, Loesche, Thomas (Ruth Aachen, Inst. Fuer Aufbereitung, Kokerei und Brikettierun G. Aachen, West Ger.), "Comparison of Dry and Wet Grinding in Flotation Sulfide Ores/Vergleich der Trocken- und Nassmahlung im Hinblick auf die Flotation Sulfidischer Erze"; Erzmetall, Vol. 37, No. 3, March 1984, pp. 120, 122-125; ISSN 0044-2658; ERZMA

1 - Ore Treatment - Flotation A533

Investigations of the flotation behaviour of different sulfide ores (PB-ZN, CU-CO, CU) after dry and wet grinding are presented, recovery rates are discussed regarding possible industrial scale application. The advantages of dry grinding are summarized. In German with English abstract.

2330 Bodily, D.M. (Utah Univ., Salt Lake City, Dept. of Fuels Engineering, Department of Energy, Washington, DC), "Effect of Maceral Properties on the Comminution of Coal, Technical Progress Report, July 15, 1984 - September 30, 1984; DE85000761;XAD, 1984, 3 p. (DOE/PC/70796-1)

081; 48A; *Coal, *Macerals, Comminution, Experimental Data, Fracture Properties, Grinding, Porosity, Separation Processes, Swelling ERDA/01300, NTISDE

Five coal samples have been obtained for the initial studies. Four of these samples were obtained from the Pennsylvania State University Coal Sample Bank. The fifth sample was obtained directly from Utah Coal Mines. These samples were selected because they show a range of vitrinite rank and contain a variety of exinite and inertinite macerals. These samples were also selected because they have been studied by maceral separation techniques. The maceral composition of these samples is shown in Table 1. The chemical and physical properties of coal macerals and whole coals which are important in the comminution of coal will be studied. Coal maceral fractions will be prepared by fine grinding and separation in a density gradient centrifuge. Swelling behaviour and micropore structure will be determined. Porous coals will be prepared by freeze drying swollen coals, fracture behaviour of the porous coal will be studied. Swelling and porosity will be related to comminution behaviour. 1 Table (ERA Citation 10:000091)

2332 Miller, K.J., Guzzo, R.F. (Department of Energy, Pittsburg, PA, Pittsburg Energy Technology Center, Department of Energy, Washington, DC), "Wet Grinding Versus Dry Grinding for Deep Cleaning Ultrafine Coal by Flotation. Technical Progress Report"; DE84017086/XAD, Sept. 84, 15 p., (DOE/PETC/TR-84/10)

081; 21D; 97K; 48A; *Coal, *Coal Fines, Cleaning, Comparative Evaluations, Experimental Data, Flotation, Grinding, Particle Size, ERDA/01300, NTISDE

Laboratory froth flotation tests were conducted with dry and wet-ground minus-400-mesh coal to determine the effect of grinding methods on clean coal recovery and product grade. A laboratory air-classifying impact mill was used for the dry grinding, and a stirred ball mill (attritor) was used for the wet grinding. Products of as near the same size distribution as possible were prepared by each method, i.e. nominal minus 27 micrometers (MU M) with a mean particle size of 10 to 12 MU M. The test results show that the dry-ground coal is more floatable (i.e. greater weight-percent recoveries were obtained at any given reagent dosage), but the wet-ground coal provides substantially lower ash products at equivalent yield. For example, the dry-ground coal yielded about 20 wt % to over 80 wt % froth product with frother reagent dosages of 0.1 to 0.5 pound per ton of dry solids (lb/ton), respectively, and the product ash contents ranged from 2.0 to 4.0%. The wet-ground coal, on the other hand, yielded about 25 wt % to a little over 70 wt % froth product with frother reagent dosages of 0.2 to 0.5 lb/ton, respectively, and the product ash contents ranged from about 1.5 to 2.0%. 4 figures, 2 tables, (ERA Citation 10:001819)

2403 El-Shall, H., Somasundaran, P. (Montana Coll. of Mineral Science & Technology, Mineral Processing Engineering, Butte, Mont., USA), "Mechanisms of Grinding Modification by Chemical Additivies; Organic Reagents"; Powder Technol., Vol. 38, No. 3, July 1984, pp. 267-273; 24 Refs; ISSN 0032-5910; POTEB

1 - Grinding Mills - Ball Milling; Surface Active Agents - Applications; Quartz - Crushing and Grinding; Dodecylammonium Chloride; Amineaminium Complexes A802; A803; A804; A482

The effect of dodecylammonium chloride on properties of quartz slurries that are relevant to grinding have been investigated. These tests were conducted under chemical conditions similar to those used in wet ball milling tests. Amine was found to improve grinding, pulp fluidity, and primary breakage of quartz suspensions, especially in the alkaline pH range. These beneficial effects are attributed to the formation of highly surface-active amineamium complexes in this pH range.

2404 El-Shall, H, Somasundaran, P. (Montana Coll. of Mineral Sciences & Technology, Butte, Montana, USA), "Physico-Chemical Aspects of Grinding: A Review of Use of Additives"; Powder Technol., Vol. 38, No. 3, July 1984, pp. 275-293; 93 Refs; ISSN 0032-5910; POTEB

1 - Crushing and Grinding - Physical Chemistry; Chemicals - Applications; Tumbling Mills A802; A801; A803; A804

The efficiency of energy utilization in tumbling mills is discussed in terms of component processes taking place inside the mill. The past reports on the effect of physico-chemical paramters of the environment on mechanical properties and grindabilty of materials are reviewed. Reported mechanisms explaining such effects are analyzed and possible ways to improve the grinding efficiency, through the use of chemical additives, are also discussed.

2414 Mishra, S.K., Gupta, A., Hall, S.T., "The Effects of Surface Active Agents on the Comminution of a Quartz Bearing Gold Ore"; Mill Operators' Conference, North West Queensland, Australia, Sept. 1982

Australasian Institute of Mining and Metallurgy, Clunies Ross House, 191 Royal Parade, Parkville, Victoria, Australia 3052, 1982, pp. 123-137; SEE: 8411-72-0720

42, Gold, Extraction Concentrating, Quartz, Impurities, Grinding (Comminution)

The grinding characteristics of quartz which is normally associated with gold bearing ores in Kalgoorlie area were

examined in a stainless steel laboratory size ball-mill in the presence of inorganic and organic surface active reagents. The cationic species considered were Fe Exp 3+, Cu Exp 2+ and the Ca Exp 2+, and the anions were Co Sub 3 Exp 2- - and S Exp 2— as these are normally present during the process of grinding of gold ores in the region. The organic surfactants examined were kamylxanthate, dodecylamine-hydrochloride and the grinding aid XFS-4272 manufactured by Dow Chemical. The study was primarily based on an examination of the electrokinetic properties of quartz surface in the presence of the grinding reagents. Zeta potential at different region additions and pH values in the presence of individual reagents were examined and the corresponding grinding characteristics determined. A correlation has been indicated between the grinding characteristics, as measured by the —53 MU M size fraction produced, and the surface energy of quartz. It was observed that an increased production of —53 MU M could apparently be aided by the reduction in surface energy of the charged sites of quartz through the adsorption of the electrolyte species. The grinding characteristics of quartz were found to be sensitive to the Fe Exp 3+ ion present. Similarly, the presence of Cu Exp 2+ ions also improved the fine production. The addition of organic electrolytes, dodecylamine hydrochloride and potassium amyl exanthate and the grinding aid XFS4272 increased the production of fines during quartz grinding. 26 Refs.—AA

2415 Berube, M.A., Marchand, J.C. (Univ. Laval, Dept. Geol. Rech. Automatisat Appl. Ind. Mienrale Grp., Quebec City, G1K 7P4), "Evolution of the Mineral Liberation Characteristics of an Iron-Ore Undergoing Grinding"; International Journal of Mineral Processing, Vol. 13, No. 3, 1984, pp. 223-237; Ref: 009

2422 Oriado, J.M., Gonzalez, M. (Fac. Quim., Univ. Sevilla, Seville, Spain (ES)), "Effect of Grinding on the Texture and Kinetic Stability of Manganese Carbonate, Cadmium Carbonate, and Lead Carbonate"; Thermochinm, Acta. Vol. 79, 1984, pp. 91-101; ISSN 0040-6031; THACA

CA166005; Grinding Carbonate Texture Stability, Managanese Carbonate Grinding Stability, Cadmium Carbonate Grinding Stability, Lead Carbonate Grinding Stability, Thermal Decompn. Carbonate Grinding Stability

Size Reduction, Kinetics of Thermal Decomposition, 598-63-0; 598-62-9; 513-78-0

2422.1 Manieh, Atef A. (Coll. Eng. King Saud Univ., Riyad, Saudi Arabia (SA)), "Dolite Liberation of Dolitic Iron Ore, Wadi

Fatima, Saudi Arabia"; Int. J. Miner. Process., Vol. 13, No. 3, 1984, pp. 187-192; ISSN 0301-7516; IJMPB

CA154001; Dolite Grinding Iron Ore

Iron Ores, Dolite

2430 Learmont, M.E., Iwasaki, I. (Inland Steel Co., East Chicago, IN, USA), "Effect of Grinding Media on Galena Flotation"; Miner. Metall. Process., Vol. 1, No. 2, Aug. 1984, pp. 136-143; 24 Refs; MMPRE

A533; A423; A545; A801; A802; 1 - Lead Ore Treatment - Crushing and Grinding; Ore Treatment - Flotation; Grinding Mills; Steel - Electrochemicstry; Galena; Steel Grinding Media; Mild Steel; Flotation Depression

Treat: X (Experimental)

Grinding with steel media adversely affects the flotation response of galena. Electrochemical measurements, flotation tests and spectroscopic and microscopic examinations were employed to identify interactions between galena and mild steel. Iron oxide, hydroxide, or sulfate species that formed on the galena surface upon contact with mild steel decreased its floatability, with the time of contact and aeration condition affecting the severity of the flotation depression. Parallel tests performed with an active metal, magnesium, indicated that floatability was also affected by the presence of a surface coating involving lead species.

2433 Klimpel, R.R. (Penn State Univ., Mineral Proc. Sect. University PK PA 16802), "Influence of Material Breakage Properties and Associated Slurry Rheology on Breakage Rates in Wet Grinding of Coal Ores in Tumbling Media Mills"; In: Jones, M.J., Oblatt R., Reagents in the Minerals Industry, 1982, pp. 265-269; Ref: 000; Pub: Inst. Mining & Metallurgy, 44 Portland Place, London, UK W1N 4BR

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2434 Berry, P, Dantini, E.M., Massacci, P. (Univ. Roma La Spaienza, Fc. Ingn. Rome, Italy), "Influence of Mechanical Characteristics of Rocks on Size-Reduction Processing"; In: Jones, M.J., Gill P. Mineral Processing and Extractive Metallurgy, 1984, pp. 15-26; Ref: 000; Pub: Inst. Mining & Metallurgy, 44 Portland Place, London, UK W1N 4B4

International Conf. on Mineral Processing and Extractive Metallurgy, Held: Kunming, Peoples R. China, 84/10/27-11/3

ISBN: 0-900488-77-8

2437 Schonert, K. (Tech. Univ. Clausthal, Inst. Aubereitung D-3392, Clausthal Zellfe, Fed. Rep. Ger.), "About the Particle Breakage and the Possibilities and Limits for Improving Size-Reduction Processes"; In: Iinoya, K., Beddow, J.K., Jimbo G. Powder Technology, 1984, pp. 331-345; Ref: 000 Pub: Hemisphere Publ. Corp., 1025 Vermont Ave. N.W., Washington DC 20005)

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LC: 83-18641 ISBN: 0-89116-285-2

2444 Bernhardt, C; Heegn, H. (Res. Inst. Min. Proc., Freiberg, Ger. Dem. Rep.), "Structural Changes, Energy Accumulation and Increase of Reactivity - A Contribution to Grinding and Mechanical Activation of Solids"; In: Iinoya, K.; Beddow, J.K.; Jimbo G., Powder Technology, 1984, pp. 442-448; Ref: 000; Pub: Hemisphere Publ. Corp, 1025 Vermont Ave. N.W., Washington; DC 2005

International Symp. on Powder Technology, Held: Kyoto, Japan, 81/9/28-10/1

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2445 Uehara, Yashuiko, Asai, Nobuyoshi, Jimbo, Genji, Iinoya, Koichi (ed.), Beddow, John Keith (Ed.), Jimbo, Genji (Ed.) (Mobara Works, Hitachi Ltd., Chiba, Japan (JP)), "Mechanochemical Effect and Pulverizing Mechanism of Graphite"; Powder Technol., (Pap. Int. Symp.), 1981, 1984, pp. 449-456; 53 TFA; Pub: Hemisphere, Washington, D.C.

CA149011; Graphite Pulverizing

Size Reduction, 7782-42-5

2263 Brayshaw, M.D., Guest, R.N. (National Inst. for Metallurgy, Randburg (South Africa), "Evaluation of a Grinding Aid in Batch Grinding, Classification, and Gravity Concentration"; PB84-100064, 5 Apr. 83, 51 p. (NIM-2108D; ISGN-0-86999-629-0)

081; 48A; *Grinding (Comminution), Separation, Beneficiation, Hydroclones, Concentrators, *Foreign Technology, NTISTFNIM, NTISFNSF

Three important aspects of mineral-beneficiation practice, *viz batch grinding* on a laboratory scale, classification, and gravity separation, were analysed in a determination of the effect of a grinding aid made by Dow Chemicals, XFS U.272.00, on each of their respective process environments. For the batch-grinding environment, it was found that fairly severe process conditions (a pulp density of 85 per cent solids, grinding aid at a concentration of 2 kg/t, and a grinding time of 30 min.) were necessary before significant increases were achieved in the grinding rates. These process conditions produced an average increase in the fineness of the product of 4.7 per cent. The effect of the grinding aid on classification was studied by the passing of the pulp, in turn, through 25 mm and 50 mm hydrocyclones and a 150 mm spiral classifier, different additions of grinding aid being used in each case. The results showed that there was a tendency for the uncorrected cut size to reduce slightly, and for the sharpness of particle classification to improve marginally when the aid was introduced.

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CA178009; Phosphate Isohypo Reaction Grinding, Mechanochem Change Isohypophosphate, Decompn Thermal Isohypophosphate

85090-36-4; 13933-52-3; 7722-88-5

2270 Takeuchi, Manabu; Nagasaka, Hideo (Fac. Eng., Ibaraki Unv., Hitachi, Japan, 316 (JP)), "Effects of Grinding on the Conductivity-Change in Cadmium, Sulfide Powder Layers Associated with Oxygen Adsorption"; Anal. Chem. Symp. Ser., Vol. 17, No. (Chem. Sens.), 1983, pp. 177-181; ISSN 0167-6350; ACSSD

CA176005; Photocond. Cadmium Sulfide Powder, Cadmium Sulfide Grinding Photocond., Oxygen Adsorption Cadmium Sulfide, Surface State Cadmium Sulfide

Adsorption, Photoconductivity and Photoconduction, Electric Resistance, Particle Size, Energy Level, 1306-23-6; 7732-18-5; 7782-44-7

1984 (G) PROCESS CONTROL, AUTOMATION

2170.11 Thyn, J, Pechlak, B. (Inst. Res. Prod. & Applicat. Radioisotopes, Prague, Czechoslovakia), "Evaluation of

Crushing and Screening of Cereals in a Hammer Mill by a Radiotracer Method"; International Journal of Applied Radiation and Isotopes, Vol. 34, No. 12, 1983, pp. 1605-1610; Ref: 007

2170.17 Rogers, R.S.C. (Kennedy Van Saun Corp., Danville, PA, USA), "Generalized Transfer Parameter Treatment of Crushing and Grinding Circuit Simulation"; Powder Technol., Vol. 36, No. 1, Sept.-Oct. 1983, pp. 137-143; 36 Refs.; ISSN 0032-5910; POTEB

1 - Crushing and Grinding; Grinding Mills - Ball Milling; Crushers A533; A802

A generalized transfer parameter treatment for simulation models of crushing and grinding devices is presented. The treatment is illustrated for existing models of batch and continuous ball mills, air-swept ball mills, vertical (ball-and-race) mills, and double-roll crushers. An extension of the treatment to size reduction devices in closed circuit is given and a single algorithm for simulating open and three common closed circuit configurations is described.

2170.43 Fuerstenau, D.W., Venkataraman, K.S., Williams, M.C. (Univ. Calif. Berkeley, Dept. Mat. Sci. & Mineral Engn. Berkely CA 94720), "Simulation of Closed-Circuit Mill Dynamics by Locked-Cycle Grinding of Mixtures"; In: Herbst, J.A., Control 84: Mineral/Metallurgical Processing, 1984, pp. 49-53; Ref:000; Pub: Soc. Min. Engineers AIME; Caller No. D, Littleton, CO 80127

1st International Symp on Automatic Control in Mineral Processing and Process Metallurgy. Held: Los Angeles, CA; 84/2/26-3/2

LC: 83-73511 ISBN: 0-89520-420-7

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2170.47 Espig, D., Lippek, E. (Acad. Sci. GDR, Freiberg, Ger. Dem. Rep.), "Fundamental Relationships for the Steady-State of Several Grinding Circuits"; In: Herbst, J.A., Control 84: Mineral/Metallurgical Processing, 1984, pp. 77-84; Ref:000; Pub: Soc. Min. Engineers AIME; Caller No. D; Littleton, CO 80127

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2170.49 Weller, K.R., Sterns, U.J., Lawry, R.K. (CSIRO, Div. Mineral Engn., Melbourne, Vic. 3001, Australia), "Computer Aided Optimization of Grinding and Gravity Concentration at the Ardlethan Tin Concentrator, New-South-Wales"; In: Herbst, J.A., Control 84: Mineral/Metallurgical Processing, 1984, pp. 185-193; Ref: 000; Pub: Soc. Min. Engineers AIME; Caller No. D; Littleton, CO 80127

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2170.51 Tikhonov, O.N. (Leningrad Min. Inst., Dept. Mineral Proc., Leningrad, USSR), "Transients and Control of Grinding Circuits"; In: Herbst, J.A., Control 84: Mineral/Metallurgical Processing, 1984, pp. 239-240; Ref: 000; Pub: Soc. Min. Engineers AIME; Caller No. D; Littleton, CO 80127

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2170.52 Lean, P.J., Eaker, D.C. (Zinc Corp. Ltd., New Broken Hill Consolidated Ltd., Broken Hill, Australia), "Grinding Circuit Control at the New Broken-Hill Consolidated Concentrator, Broken-Hill, Australia"; In: Herbst, J.A., Control 84:

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18th International Symp. on Application of Computers and Mathematics in the Mineral Industries, Held: London, England, 84/3/26-30

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In: Cahalan, M.J., Shaw, C.T., Application of Computers and Mathematics in the Mineral Industries, 1984, pp. 69-78; Ref: 000; Pub: Inst. Mining & Metallurgy, 44 Portland Place, London, UK. W1N 4BR

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2209 Anon., "New Crushers, Micrprocessor Control Double Output at Century-Old Quarry"; Pit Quarry, Vol. 76, No. 8, Feb. 1984, pp. 37-39; ISSN 0032-0293; PIQUA

1 - Quarries and Quarrying - Computer Applications A505; A723

The quarry at Frederick, MD., has been updated by Genstar Stone Products Co., with new primary, secondary, and tertiary crushing facilities, microprocessors for production control and remote video monitoring devices. The expansion and renovation, completed in 1983, has increased hourly output of crushed stone from 550 tons to more than 1,000 tons.

2210 Ford, M.A., King, R.P. (Counc. Miner. Technol., Randburg, S. Afr., 2125 (ZA)), "The Simulation of Ore-Dressing Plants"; Int. J. Miner. Process., Vol. 12, No. 4, 1984, pp. 285-304; ISSN 0301-7516; IJMPB

CA154001; Ore Grinding Flotation Model

Process Simulation, Ore Treatment, Ore Treatment

2216 Pohjola, V.J. (Helsinki Univ. of Technology, Helsinki, Finl.), "Analysis of Recycle System with Selective Recycling - I. Theory"; Chem. Eng. Sci., Vol. 39, No. 3, 1984, pp. 479-483; 7 Refs.; ISSN 0009-2509; CESCA

1 - Crushing and Grinding A533

In recycle system with selective recycling the material handled is subjected to classification with the consequence that the fraction recycled is different by some of its properties from the fraction discharged. Closed-circuit comminution is a typical representative of such a system. The residence time distribution (RTD) of material in recycle system with selective recycling is given in terms of the number of cycles distribution (NCD) of the system and the RTDs of the units.

2217 Pohjola, V.J. (Helsinki Univ. of Technology, Helsinki, Finl.), "Analysis of Recycle System with Selective Recycling - II. Time-Smoothed Approximants"; Chem. Eng. Sci., Vol. 39, No. 3, 1984, pp. 485-489; 4 Refs.; ISSN 0009-2509; CESCA

1 - Crushing and Grinding A533

The residence time density of a recycle system is generally an oscillating function of time because of the lag between the cycles. In recycle system with selective recycling classification, however, tends to damp the oscillations. A general expression for a time-smoothed residence time density of recycle system with selective recycling, composed of pure time delays, is derived starting from the number of cycles distribution (NCD) of the system and by treating the number of cycles as a continuous instead of a discrete variable. The same expression is applied to a general recycle system with selective recycling, having any degree of mixing in the units which the system is composed of, by treating the variance of the NCD as an adjustable parameter.

2224 Nelson, E.F., Broom, R. (Jacobs Engn. Grp. Inc., Washington, DC 00000), "Grinding Circuit Control Philosophy"; In: Amer. Inst. Min. Met. & Petr. Engineers, Soc. Min. Engineers, Practical Hydromet. 83, 1983, pp. 53-71, Ref: 000; Pub: Soc. Min. Engineers AIME; Caller No. 3, Littleton, CO 81027

7th Annual Symp. on Uranium and Precious Metals, Held: Lakewood, CO 83/8/22-24

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Use of steady state mineral process simulators for conducting plant studies is now widespread in the mineral industry. However, only recently has the industry shown interest in dynamic simulation for the investigation of the dynamics and control of processing circuits. With this interest has come the requirement of a simulator suitable for studying the behaviour of different circuit configurations. To facilitate the development of the simulator presented in this work, the well-documented Fortran-based process simulation program language, developed by Franks, known as Dyflo, has been adopted as the basis for the executive, utility and program structure. Application of the simulation program is illustrated by studying the control performance of a conventional rod mill - ball mill grinding circuit. The features of this approach to dynamic simulation which allow the user to easily alter the grinding circuit configuration and/or control strategy are outlined.

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The report describes the successful application of a multivariable controller to an industrial milling circuit. Setpoints for the controller are the particle size of the product, and the flowrate and density of the slurry fed to the primary cyclones. Simple guidelines have been established for the selection of optimum setpoints that maxmize the throughput at the chosen size of product.

2440 Orrock, G.I., "A Study of Grinding Circuit Control Using an On-Stream Particle Size Monitor"; Broken Hill Conference -- July 1983, Broken Hill, N.S.W., Australia, July, 1983; Australasian Institute of Mining and Metallurgy, Clunies Ross House, 191 Royal Parade, Parkville, Victoria, Australia 3052, 1983, 287-296; See: 8411-72-0709

41, Beneficiation, Concentrators, Grinding (Comminution), Process Control

The control of industrial grinding circuits in Australian concentrators has been practised for many years in one form or another. Some have established simple feedback loops in areas such as fine ore bin feeders (tonnage control), mill pump sump levels (flow control) and water additions (density control). There are also some sophisticated systems which infer circuit product size using complex measurements of mass flows and water additions in the circuit and attempts are made to control those flows to produce a constant circuit product size. The inferred size method in Australian concentrators has become firmly entrenched in the last ten years and control techniques involving the use of direct size measurements with reliable on-stream sizers have been ignored. An on-stream sizer has been operational at North Broken Hill Limited's concentrator since April 1980 and has provided a reliable measurement of grinding circuit product size on one of the three circuits since that time. With the addition of a suitable minicomputer in 1981, early work on a suitable scheme to control the grinding circuit has indicated that the significant variations in product size that can occur very rapidly due to changes in ore grade make good control difficult to achieve.

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Australasian Institute of Mining and Metallurgy, Clunies Ross House, 1919 Royal Parade, Parkville, Victoria, Australia 3052, 1983, 335-343; See: 8411-72-0709

41, Lead Ores, Beneficiation, Zinc Ores, Concentrating, Grinding (Comminution), Classifiers

The expansion of New Broken Hill Consolidated Limited (NBHC) concentrator necessitated the installation of hydrocyclone classifiers where rake classifiers had previously been used. Commissioning of the circuit and optimisation of circuit performance has highlighted problems related to classification of sulphide minerals. Testwork initiated to solve these problems has been used to develop cyclone models which have been incorporated in a computer control strategy for the grinding circuit as a whole. The modifications to the circuit during the commissioning phase and the control philosophy are outlined.

2410 Rowland, C.A., "Testing for the Selection of Communition Circuits to Prepare Concentration Feed"; Mill Operator's Conference, North West Queensland, Australia, Sept. 1982

2411 Thirlwall, L.G., Howell, I.J., Kirsopp, R., "Crusher Mainframe Failures - Mount Isa Mines Limited"; Australisan Institute of Mining and Metallurgy, Clunies Ross House, 191 Royal Parade, Parkville, Victoria, Australia 3052, 1982, 241-250; See: 8411-72-0720

41, Copper Ores, Beneficiation, Crushers, Components, Mechanical Properties, Fatigue (Materials)

Severe fatigue cracking in copper ore, tertiary, low-carbon steel crusher mainframes indicated that they had exceeded their fatigue life earlier than planned. New heavy duty mainframes were ordered. Meanwhile, steps were taken to reduce off-centre feeding, to improve preventative maintenance and to introduce higher tolerance levels, the damaged units were refurbished by removal of the low carbon surface layer, grinding out and stopping cracks and making good with hydrogen free, peened welds. This gave the additional year of operational life needed prior to delivery of new units.

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